



GREEN JOBS

FOR SUSTAINABLE
DEVELOPMENT

A case study of Spain



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Green jobs for Sustainable Development

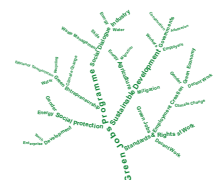
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Executive Summary

The green economy offers enormous opportunities for job creation, many of which are already underway in the Spanish economy. These opportunities range from the sectors traditionally associated with an environmental content, such as renewable energies or recycling, and to other activities that represent emerging sectors in green jobs, such as sustainable mobility and activities in “traditional sectors” with potential for conversion into sustainable activities, such as production of cement, steel or paper.

This study aims to compile and analyze the data on green job creation generated by different institutions in recent years. This includes both current employment data and also studies of trends for some sectors. This study has been undertaken in an especially delicate moment for the Spanish economy, and this fact is reflected in the paradoxical nature of some of its conclusions. While the green sectors show good results in recent years, the impact of the current economic crisis and the modification of policies can considerably reduce the options of this growth tendency.

In Spain, the severity of the recession and the current austerity measures make it difficult to judge the future effect of general contracting in the sectors of the green economy. Nevertheless, some recent studies in Europe have demonstrated that these sectors have weathered the recession better than others by retaining more employment, and hence they would be particularly well situated for a future scenario of investment intended for the recovery of European economies.

At present, the discussion on the re-launching of the economy is especially relevant in Spain. The sectors of the green economy for Spain are a good opportunity to increase competitiveness, promote the creation of quality employment and reduce the economy's environmental impact. Due to the severity of the employment crisis in this country, priority must be given to sectors such as these that help generate a sustainable productive fabric with high job creation.

The measures adopted in recent years for promoting a more sustainable economy in Spain have born their fruits. The most recent studies indicate that there are between 400,000 and 500,000 green jobs in Spain, equivalent to 2.2% of the country's total employment. Moreover, the green economy's contribution to the Spanish national product is estimated at 25 billion Euros per year, or 2.4% of the total Gross Domestic Product (GDP) at market prices (Escuela de Organización Industrial –EOI–, 2010).

This is a very considerable evolution, since jobs have passed from 158,500 green jobs 1998 to nearly 531,000 in 2009, a change that represents an increase of 235%. In terms of the weight of green jobs in total employment in the country, the change is also considerable. Considering the comparable information from 1998 and 2009 alone, we may assert that green employment has grown from 1.12% of total employment in 1998 to 2.81% at present. It is important to note that these data only include jobs the traditional green sectors. To these may be added,

for example, the data generated by means of sustainable transport, which are not included in this figure, but will be considered in chapter 4 of this report.

Green jobs are distributed among 61,000 companies that include an ample group of activity sectors. The renewable energy and waste management sectors, with 21% and 26% respectively, represent almost half of the green jobs. Employment in renewable energies showed a spectacular growth in recent years. Between 1998 and 2009, the number of people employed in the sector increased from 3,500 to 109,000 which is an expansion of 3,005% or an average of 37% each year during this period. Other sectors with high concentrations of green jobs are environmental services to companies and entities, and services to the Public Administrations (Observatorio de la Sostenibilidad y Fundación Biodiversidad –OSE-FB–, 2010).

In addition to jobs in sectors traditionally associated with environmental content such as renewable energy or waste management, Spain has many emergent sources of green jobs and activities with potential to convert sectors that have traditionally been less sustainable into activities with respect for the environment. This is the case of some activities that incorporate elements of energy efficiency or savings into their production process or final products. These activities include sustainable transport, construction with environmentally sustainable criteria, the manufacture of low-carbon automobiles, secondary production of steel or aluminium and the production of cement and paper that use recycled products as raw material to name a few.

Spain is one of the leading countries in Europe in promoting the green economy. In 2006, a study by the European Trade Union Confederation highlighted Spain and Germany as the two EU countries that have implemented the complete spectrum of policies and measures including all sectors responsible for CO₂ emissions (energy, manufacturing industry, transport, service and residential sectors). In 2008, the Organization for Economic Co-operation and Development (OECD) indicated that together with Finland and Denmark, Spain actively promoted the export of environmental goods and services and supported local companies to favour their expansion into global exporters. A study

from the International Labour Organization (ILO, 2011a) that assessed Europe, identified Spain, Germany, France and the UK as the countries that responded to the economic crises with green stimulus measures, which include investments in energy efficiency in buildings, low-carbon vehicles and other forms of sustainable transport.

Legislation: a key factor

Together with the progressive improvement of knowledge and society's greater ecological awareness, the main driving force for the creation of activities and jobs related with the environment is the complete broad range of legislation –environmental, economic, labour-related and sectoral–, including regulatory, planning, and management mechanisms. The implementation of the strategies, laws, plans and programmes implies the definition, development and, on occasions, direct financing of employment niches related with the environment.

Spanish regulations, like the European ones, include a complete body of legislation in environmental matters and different aspects related with sustainability that form the basis for the promotion of a green economy. The transition to more environmentally sustainable development would not be possible without this group of regulations. As will be seen in the course of this report, the set of standards, plans and programmes implemented in Spain up to the end of 2011, both at the national and sectoral levels, has had an impact on all economic activities. Their complete implementation is already generating ecological conversion processes. Spain has already created and displays potential to continue creating an appreciable number of green jobs in the future (OSE-FB, 2010).

Nevertheless, although sustainable production has benefited from these measures, the recession and the adjustment measures that have been implemented since 2010 and have continued until this year 2012, have introduced fundamental changes in the expansion scheme of the green economy and the associated jobs. These slow-down measures will not only have an impact in environmental terms, but will also have an important impact on employment, generation of income and the country's growth.

Green jobs in the context of the economic crisis

The accounting of green jobs in Spain and its special and sectoral distribution, which are analysed in this report, are based on data from the years 2010 and 2011, and hence they do not incorporate the change in the trend that can reasonably be predicted based on the changes in the recent policies mentioned. The effects of the economic crisis in Spain are especially severe. The instability provoked by the sovereign debt crisis, the measures for reinstating budget austerity, the decline of the construction sector, the company's difficulties to access financing, have generated a very severe crisis in the destructive detriment of economic activity and employment.

At the beginning of 2012, there were 5,639,500 people unemployed in Spain, an unemployment rate greater than 24.44%. The data revealed by the Spanish National Institute of Statistics (INE) in the corresponding measurement of the Economically Active Population Survey (EPA) suggest that the labour market in Spain will continue the clear downward trend it has exhibited since the beginning of the international economic crisis in 2008. Hence, between the first three months of 2008 and the first three months of 2012, the number of unemployed in Spain increased by almost three and one half million people, and 15 percentage points (from a rate of 9.63%).

Moreover, Spain depends to a considerable degree on foreign energy. The presence of petroleum and its derivatives in the consumption of primary energy in the country is notably superior to the European average. This fact, together with the low domestic energy production, practically centred in renewable energy resources, in nuclear energy and the small contribution from national coal, gives rise to an elevated dependence on foreign sources which is nearly 80% of total energy consumption (Ministry of Industry, Tourism and Commerce, 2010).

In the context of an economic recession and facing the challenges in the fields of energy and the environment, green jobs appear to represent a possible approach to the creation of sustainable and quality employment. Green jobs initiatives have a dual aim. On one hand, to fight against environmental threats, allowing the development of future generations, and on the other hand, to offer decent work in a context in which millions of people

are excluded from economic and social development. Spain's specific environmental and employment challenges make them especially interesting.

In this respect, it may be emphasized that according to a study by the European Commission from 2012, the creation of employment in the sectors tied to the environment has continued to reflect a positive trend during the recession in comparison with other sectors. From 2.4 million jobs in 2000, it became 3 million in 2008, and it is expected that to reach 3.4 million in 2012.

The challenge of a just transition to a green economy

With decisive policies to support the sectors that could be especially interesting for reactivating the economy and emerging from the crisis, according to estimates (FB and OSE) there could be more than one million green jobs in Spain in 2020.

But in terms of the transition to the green economy, there is an additional aspect to be considered. The advance of the green economy could also make it necessary to adapt jobs in sectors with very high environmental impacts. This could be the case in segments such as vehicle production with high energy consumption or industries based in the extraction of resources or materials. For an economy like Spain's, which is at a crossroads, the decisions are complex, especially when they affect jobs.

The most contaminating industries are those that should most probably be subjected to structural reforms (ILO, 2011b). It is here where we may expect the employment level to decrease and/or the composition of jobs to be modified. In this scenario the preparation of the workforce to confront the changes in the capacities and aptitudes demanded by the new jobs takes on a crucial relevance. All agents, governments, employers, and workers involved have a role to play in this process. A study from the ILO (2011a) found that the regions are playing a primary role in the identification of the skills needed for jobs in a low carbon economy. The regional players are well positioned to identify the strengths and weaknesses at the local level, and they are in conditions to bring together key agents as representatives of industry, research institutes and education and training centres to work out appropriate responses.

Production will increase to the extent that green economy sectors increase their participation and demand and an additional group of jobs will arise in the economy's other industries. These are the indirect jobs that represent opportunities for salary and income, although they cannot necessarily be considered green jobs.

The increasing requirements for environmental responsibility from companies lead us to predict an increase in demand for waste management services that could be translated into an impact on environmental employment.

From a work-related standpoint, one more aspect that must be considered in the process to further develop a model towards the green economy are the measures that would aim to improve the preparation of the labour market for the demand for green jobs. Policies for training and developing skills are fundamental for assisting workers during the transitional period, especially for the jobs affected by the transformation of productive processes on the road toward a green economy. There is no explicit national strategy in Spain that addresses the training needs for a greener economy in spite of efforts to include professional training measures in environmental policies and the progressive introduction of different programmes related to the environment in the higher education system.

The main green jobs sectors

The sectoral analysis developed in the previous sections shows that Spain already has a significant group of green jobs, developed infrastructures and a mature business fabric, which enables the continuation of previous measures and the implementation of new planning instruments to create many more green jobs. More specifically, at the sectoral level, the following trends emerge:

- In **renewable energy**, there are currently 148,394 jobs, between 88,209 direct jobs and 60,185 indirect jobs. The development of the renewable energy sector offers many advantages that go beyond the employment-related aspect to include issues such as improvement of domestic accounts and the improvement in quality of the service provided. The presence of petroleum and its derivatives in the consumption of primary energy

in Spain is notably superior to the European average. This fact, together with the low domestic energy production, practically centred in renewable energy resources, in nuclear energy—for which Spain imports 100% of enriched uranium used in the plants—and the small contribution from national coal, gives rise to an elevated dependence on foreign sources which is nearly 80% of total energy consumption (Ministry of Industry, Tourism and Commerce, 2010).

The direct contribution from renewable energies to Spain's GDP was roughly 7.4 billion Euros in 2009. This represents a real growth of 56.7% since 2005. The sector's indirect contribution reached 3 billion Euros in 2009, making the total contribution 10.283 billion Euros, roughly 0.98% of the GDP in Spain in that year (IDAE, 2011a).

If by approximately 2020 a renewable energy quota of 20% could be established from primary energy, the sector would grow to 124,265 direct jobs. That would be 81.5% more than exist today. As far as technologies, the greatest job growth can be observed in the manufacture and installation phase in solar thermal energy, 378%. It is expected afterward that this technology will complete its consolidation in the domestic market in the coming years. By 2015 and 2020, the direct contribution of the renewable energy sector to the GDP in Spain would represent growth over the contribution registered in 2009 by 28.2% and by 66.6%, respectively. Other favourable results include a positive and growing commercial balance, and also a greater growing contribution to R&D&I.

As has been said, these projections have not been reviewed under the current severe economic crisis, not even after the introduction of Royal Decree-Law 1/2012. It includes sector estimates that predict a reduction to less than 20,000 jobs. In solar photovoltaic energy alone that is a reduction of 10,000 jobs due to the abandonment of projects after the suspension of procedures to pre-assign remuneration and the suppression of economic incentives for new electric energy production based on co-generation, renewable energy sources and waste products that the Decree stipulates. Just as the sector's expansion creates direct, indirect and induced jobs, the decrease in investment in the

sector and the abandonment of projects that produce renewable energy affects both the workers of the industry as well as the industries that supply consumables and cause the overall spending level to contract.

The destruction of jobs in the renewable energy sector could bring about industrial dislocalization and the transfer of technology to third countries. Although in the short term we could expect the rhythm of the sector's expansion to slow down, authorities have communicated that the measure does not compromise the energy objectives established for 2020.

Generally, jobs in the renewable energy sector boast better indicators than those for rest of the energy sector or the average for the overall economy. There is evidence for Germany and Spain that jobs in renewable energies are mainly permanent and full-time positions with only a small share of temporary contracts. As has been observed the predominant type is an open-ended contract (83.7%). This category is followed, by temporary contracts (14.1%), contracts for training/internships (0.9%) or freelance contracts (1.2%).

The average salary in the companies analysed comes to 32,817 Euros, 52% greater than the national average and 37% greater than the industry's average salary. This is completely consistent with the higher qualification of the sector's workers, their greater productivity, effort in R&D&I and tendency to export. In Spain, women represent 26.6% of employees in renewable energy companies, and men 73.4%.

- **Sustainable transport** is one of the basic pillars of a green economy among other things because this sector is one of the main contributors to total Greenhouse Gas (GHG) emissions. The Eurostat statistics for the last two decades indicate that the contribution of this sector to total CO₂ emissions in Spain is more than 8 percentage points higher than the EU-27 average.

The negative effect of transport including environmental contamination, accidents and traffic are particularly high in Spain. Recent estimates calculate that in 2010 the external costs of transport in Spain could have reached 31.1 billion Euros.

The distribution of means of transport, with clear predominance of highway use to transport

merchandise and travellers, with preference for the use of individual cars in this latter case, does not favour a reduction on environmental impact. Of travellers who go by road, 86.4% use individual vehicles, 12.8% go by bus and less than 1% ride motorcycles. In addition, transport growth is skewed to highway and airplane travel instead of rail and sea travel.

Green jobs in the transport sector are the result of applying policies of sustainable mobility that generate employment in decent work conditions. The opportunities for green job creation are found in the sector's production and service supply such as the promotion of quality public transport, sustainable mobility plans and improvement in vehicle efficiency.

The majority of analytic approximations consider jobs in public transportation as green employment (See UNEP, ILO, OIE, ITUC 2008, UNEP 2011).

According to data disseminated by the Ministry of Public Works in 2011, public transport in Spain employs roughly 843,500 people. This figure includes the transfer of passengers and merchandise by train, other types of land transport, sea transport, navigable rivers, air transport, transport associated activities. According to the previous definition, all these jobs will be included among the sector's green jobs.

More restrictive measurements have yielded a somewhat smaller quantity of green jobs. Counting only passenger transport, 261,466 jobs in sustainable transport were recorded in 2008 (Fundación Conde del Valle de Salazar in collaboration with Comisiones Obreras, 2010). This category includes all transport by train, metro, tram, bus, taxi and car rental.

For its part, the OSE-FB (2010) suggests that in the sustainable transport field 40% more jobs could be created by 2020, moving from the current 560,000 jobs to 770,000 jobs in service activities, industrial activities and infrastructure construction. These estimates are based on the President's Economic Report for 2009, and they include both the public sector and the private sector, certain industrial activities such as railroad material production and civil naval construction, and the manufacture of low-carbon vehicles, which is estimated to employ 85,000 people.

In the case of Spain there is evidence that

additional measures, especially those oriented to a greater energy efficiency of the vehicle fleet, would have a positive environmental impact and would favour the creation of employment. The oldest 20% of the fleet is responsible for 80% of the pollution created, and reports indicate that the renewal of the fleet or part of it would allow important energy savings and would help to maintain jobs (Asociación Nacional de Fabricantes de Automóviles y Camiones –ANFAC–, 2011b). An expansion plan for sustainable transport methods, including the bicycle and the transport on foot, yield a result that by 2020 will have generated 122,000 more jobs than if the plan had not been implemented.

Gender inequality and the continuing risks to health and safety that confront the sector's workers continue to be the main obstacles to decent work. A series of measures oriented to improving the workers' preparation, including professional training, would improve the working conditions for hundreds of thousands of workers, and it would be a significant advance toward sustainable mobility on the way to just transition.

- The **construction sector** is fundamental to the Spanish economy, and it has played a decisive role both in periods of economic expansion and of recession. In 2009, the construction sector contributed 105 billion Euros to Spain's Gross Domestic Product (GDP) (10% of the total), and in 2012 it provided jobs for 1,650,800 workers (9.0% of all employed workers)

In recent years, the country has had to confront, at the same time, the global crisis and its own crisis associated to a growth model based excessively on construction and housing. By the fourth quarter of 2011, the construction sector registered 453,000 unemployed workers (INE 2012), 8.6% of all unemployed and 18% of the unemployed who recognize affiliation with an economic sector.

An estimate of green employment in the activity is given by the jobs linked to rehabilitation of buildings, and within these, to those related to energy efficiency improvements. At present, these amount to roughly 32,744 jobs.

A rehabilitation plan for a building stock of 25 million housing units would make it possible to rehabilitate 565,000 housing units per year, roughly 2%. By 2040, this would mean that 58%

of the existing stock could be rehabilitated. The rehabilitation plan could be carried out through better isolation, use of renewable energies or more efficient equipment and could generate up to 1.37 million jobs during the implementation of the complete project and more than 100,000 stable jobs in 2020. This sort of plan would require an investment of 329.2 billion Euros, meaning, in turn, a payment of 22,560 Euros per treated housing unit. The most interesting thing is that this is a "zero-cost" investment since it would be amortised in the course of the years by energy savings and energy production resulting from the rehabilitation.

Regarding the level of qualifications required for green jobs, some authors have indicated that the majority of the occupations will be similar to the ones already existing in the construction sector, incorporating specific key technical and training requirements (OSE-FB, 2010). In addition it is important to stress that a series of new professional profiles will be needed that are specific to the rehabilitation processes (Instituto Sindical de Trabajo, Ambiente y Salud –ISTAS– and Fundación Conde del Valle de Salazar, 2010). Rehabilitation may be an opportunity to achieve an important improvement, both quantitatively and qualitatively, in employment in the sector. Public policies in support of the sector and the workers are necessary in order to create this change, and they require important training plans to adapt workers' knowledge at the conceptual and technical level in many cases.

- **Waste management** is a key sector of the green economy, not only because it is the sector of activity that generates the greatest volume of jobs within the green economy, but also due to the implications in their expansion into crucial questions such as people's health and hygiene. At present the sector employs 110,000 workers according to the most conservative estimates, which is 26% of all jobs generated by the green economy.

It is important to emphasize that in Spain the growth of employment in this sector occurs in conjunction with the decrease of waste generated per capita during the same period, coming progressively closer to the per capita waste generation levels in the EU-15 (FB and OSE, 2010). The average drop in income in the population due to the economic crisis

is also among the causes that have motivated the decrease in urban waste generation.

As for its potential for creating employment, according to a study drafted by the ISTAS in Spain, up to 14,000 jobs could be generated if a deposit, refund and return system for beverage packaging (SDDR) would be implemented in this country. The fact that the study refers only to the packaging market implies that there is a significant margin for improvement in job creation if urban waste recycling objectives were expanded. Regarding other characteristics of the jobs generated, this would also present a case for stable employment.

Other future employment forecasts in the sector include those presented by Cátedra ECOEMBES. Based on recent studies, a forecast has been made for direct jobs in urban waste management until 2016 indicating that at present the main niche for green jobs in Spain is precisely waste management, likewise indicating forecasts for growth and professionalization. These projections predict that the volume of direct employment created by 2016 will amount to 27,850 direct jobs.

Based on fieldwork in the sector the document from FB and OSE (2010) reports that 98% of jobs are on-going and full-time according to the type of contract. Only 1.9% of workers with on-going contracts are part-time, and the percentage of discontinuous employment is almost imperceptible (0.1%).

- **Basic industry** is an important sector in the Spanish economy that supplies consumables to other sectors of activity such as transport, energy and construction. Recycling is what brings sustainability to the iron and steel, aluminium, cement and paper industry. By reusing materials, energy is saved, along with all the rest of the materials incorporated into the products.

The statistics on green jobs in the basic industry present greater difficulties when it comes to individualizing branches of activity analyzed in this report. Generally speaking, for the production of iron and steel, aluminium, cement, paper and paste, recycling is the option for creating green jobs. The use of recycled steel consumes from 40 to 75% less energy than conventional steel. Likewise, the consumption of recycled aluminium requires 5% of the production energy of conventional aluminium.

Available data indicates that in Spain secondary steel production represented 88% of total production in 2008. Other countries with important steel production quotas based on recycling are Italy (77%), United States (64%), South Korea (52%), Russia/Ukraine (48%) and Germany (45%). The percentage of recycled steel in Brazil, China and India is considerably less (Renner, 2009). Data from 2011 indicate that in Spain 60% of aluminium comes from recycled materials.

It is important to stress that negative impacts have not been detected on the number of jobs in the iron and steel sector as a consequence of environmental measures resulting from the National Assignment Plan for greenhouse gases and related measures. The effects of the crisis have not yet been felt, although since the year 2009 employers –Unesid– and the government coincide in an unfavourable prognosis.

In the cement production sector, in spite of the re-use of cement as a raw material as one of the main environmental measures in the sector, it only reaches a mere 10% of Spanish production. The drop in construction and perhaps the relative appreciation of the Euro has affected this industry in an important way. In 2011, exports dropped by 1.1% compared to 2010, and imports also fell by more than 39% in the same comparison (Oficemen, 2012).

These measures for converting the industry to more sustainable levels require the adapting of workers' professional skills. Nevertheless, a training strategy for the industry in this regard does not yet exist.

In the paper industry, in spite of the global context and the evidence of a slow-down between 2007 and 2008, production increased consistently through the whole 2005-2008 period. The paper industry occupied 45,300 workers in 2012, equal to 0.25% of the active workforce.

As for the sector's sustainable segment, in 2010 the Spanish paper industry recovered 71.9% of the paper and cardboard consumed in Spain for recycling, or more than 5 million tons of used paper. This figure puts Spain at the forefront of Europe, only behind Germany in volume of recycled paper and almost at the level of France and Italy.

Although with fewer models and quantitative estimates than those observed for other sectors, the perspectives for job creation in the sectors analysed range from good to excellent.

In order to obtain a just transition to a more sustainable productive system that offers opportunities for all, the need has arisen to inform the debate and to contribute to the discussion of the interventions taking place. This should include an analysis of the Spanish economy's potential to create green jobs and approximate their characteristics and to identify other effects on employment due to the transition to a more sustainable economy.

The work below represents the contribution made to the research and analysis of green jobs in Spain. This work seeks to show the main aspects of the current situation, evolution and development, in addition to the relevant players' future expectations of them.

The report is laid out as follows. After the introduction, the second section describes the labour dimension of current regulations governing

sustainable development, particularly in the sectors analysed in this study. The third section offers figures from Spain's green economy according to the available estimations with a summary of current and expected green jobs in the sectors analysed in this study. The fourth section analyses these sectors, covering green jobs in the renewable energy, sustainable transport, construction and waste management sectors in succession. When statistical sources and other qualitative evidence allow, a deeper discussion is included on the contribution made by each sector to the economy and employment in Spain, the evolution of green jobs in the sector, the likelihood that jobs will be created in the sector in the future and the characteristics of those jobs. The fifth and final section offers some closing comments and proposes areas for future research.

The labour dimension of sustainability policies and programs in Spain

2

Growing evidence of the global effects of climate change and the need for policies to adapt and mitigate these have been major drivers of green employment policies on a global scale (FB and OSE, 2010). In recent years, in line with the EU approach, Spain has amassed an extensive body of legislation governing the environment and numerous aspects related to sustainability. When all of these have been fully implemented ecological reconversion processes will be generated, creating a significant number of green jobs.

In recent years, proposals for action have reached a large number of areas of activity. In terms of the sectors dealt with specifically in this report, i.e. renewable energies, transport, construction and waste management, these have been subject to proposals for interventions that generally seek to boost sustainability in the respective production areas. The programs adopted in recent years seek to develop renewable energies, achieve greater sustainability in transportation and mobility, attain greater energy efficiency in construction and increase the recovery rate of materials through waste management, among others.

These programmes have been threatened by the rate of unemployment in Spain since 2008, which have prompted the authorities to pave the way for reforms that give high priority to employment. This means that the programmes deployed are accompanied by specialised studies that include numeric or qualitative estimates of the impact expected that the measures proposed will have on the level and quality of employment in addition to other macroeconomic and sector variables of interest, such as production, Gross Value Added (GVA) and Greenhouse Gas (GHG) emission levels.

As mentioned above, at the beginning of 2012 some of the support agreed to be given to sectors in planning instruments was threatened by the deepening recession and the economic adjustment measures that have been approved. These measures have already affected the development of renewable energies, particularly wind and solar energy. However, the expected impact of a turnabout affecting the remaining programmes embarked upon is not entirely foreseeable.

For a full description of the current measures, see Annex 1.

3.1. The current situation

Specialised studies have been conducted in recent years that give a comprehensive diagnosis of the green job situation in Spain. Apart from some one-off discrepancies, these studies all agree that there has been a significant growth in the number of green jobs in Spain in recent years and the significant weight of waste management, renewable energies and energy efficiency factors in relation to the total.

This chapter summarises the different calculations of the figures for the green economy that are currently available. The panorama for green jobs in the sectors analysed is also presented in this report which includes the current situation and projections made for them for 2020 based on certain intervention hypotheses.

The studies that proffer estimates for green jobs in the economy as a whole reviewed in this report are published by the Spain's School for Industrial Organisation (EOI according to its initials in Spanish) and the Observatory on Sustainability in Spain and Fundación Biodiversidad (FB and OSE according to its initials in Spanish, 2010).

There are other studies that analyse green employment in certain sectors of the economy (photovoltaic solar energy and wind power, for example) which tend to be taken into consideration in those global reports, thus they will not be dealt with separately here. Some of the most important studies on green sector jobs in the renewable energy area are produced by Union Institute of Work, Environment

and Health (ISTAS, 2010) owned by the Spanish Trade Union Comisiones Obreras and there are also studies of the transport and construction sectors published jointly by ISTAS and the Fundación Conde del Valle de Salazar (2010a, 2010b). These are dealt with specifically in the respective chapters of this report.

The main objectives of the EOI 2010 study are to offer an approximation of the size of the sustainable employment market and that of the green economy in Spain and to analyse its future prospects.

- To estimate the size of the green economy, the study follows the guidelines in the Environmental Goods and Services (EGSS) Industry Manual for Data Collection and Analysis. OECD/Eurostat¹ and classifies green economy activities as follows: core or characteristic activities: Services whose main purpose (principal activity) is to protect the environment.
- Connected or related activities: Economic activities (goods and services) whose main aim (main activity) is production of non-environmental goods and services, but which have close links to the environment, because according to this classification they are divided into three sectors and 13 subsectors in both activity classifications, as shown in Table 1.

¹ *The environmental goods and services industry: manual for data collection and analysis* (OECD/Eurostat, 1999).

Table 1. Delimitation of EGSS by subsectors

	Sectors	
Environmental protection	1	Control and prevention of air pollution
	2	Treatment and purification of waste water
	3	Waste management, treatment and recycling
	4	Control and prevention of soil pollution
	5	Control and prevention of noise pollution
	6	Natural area management
Resource management	7	Water management
	8	Forest management
	9	Renewable energy and energy efficiency (*)
Independent productive activities	10	Research and development (public and private)
	11	Environmental services to companies and entities
	12	Environmental education, training and information
	13	Government bodies

Source: Based on EOI, 2010.

(*) The renewable energy sector includes hydropower, wind energy, thermal solar power, biomass energy and biofuel production.

Table 2. Basic green economy figures, 2009

	Number of companies (billions of Euros)	Persons employed	Production (billions of Euros)	GVA (billions of Euros)	Apparent productivity from work
Characteristic activities	59,169	319,942	37,588	20,050	62,669
Connected or related activities	2,102	91,342	15,578	5,089	55,709
Total green economy	60,792	407,191	52,706	24,966	61,314

Source: Based on EOI, 2010.

Based on an analysis of the activities of 40,000 companies, which included representative samples of the different sectors by branch of activity, the study provides estimates of the dimension of the green economy in terms of the number of companies it covers, its contribution to employment, production, to the GVA and the value corresponding to the apparent productivity of the work, calculated as GVA per person employed. The results are summarised in Table 2.

When characteristic and related activities are considered together, there are more than 60,792 companies and institutions in Spain's green economy. They employ around 407,200 people, with a production value of almost 52.7 billion Euros and an added value of around 25 billion.

In relative terms, and according to 2009 data, the green economy represents 2.2% of all jobs in the Spanish economy and 2.4% of GDP at market

prices. The activities making up the core of the green economy, most of them services, account for 2.9% of total GDP from services.

According to this study, the distribution by employment sector is as shown in Table 3.

When core and related or connected activities are added together, the sector generating the most employment is waste collection and treatment, with 110,000 jobs (27% of the total). This is followed by the renewable energy sector, with 95,000 jobs (23%) and the consultancy, auditing and environmental technical assistance sectors, with 61,000 jobs (15%).

As shown later on, the ranking order of the sectors from the standpoint of volume of jobs generated coincides with the data garnered from other studies.

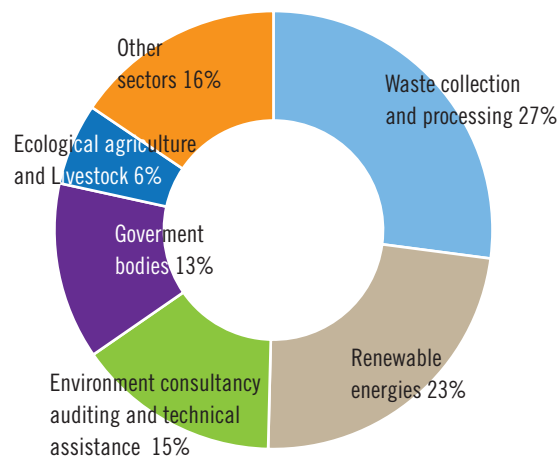
The FB and OSE 2010 report takes a dual approach to analysing activities related to the environment and green employment. On the one hand, activities traditionally associated with green

Table 3. Distribution of green jobs by sector. (EOI, 2010)

	Core	Related activities	Total
Waste management and processing	108,335	1,692	110,027
Renewable energies	11,327	83,410	94,737
Environment consultancy auditing and technical assistance 1 (multi-area)	60,887		60,887
Government bodies	53,072		53,072
Ecological agriculture and animal breeding	24,485		24,485
Environmental education and training (regulated and continuous)	15,175		15,175
Forest management	12,715		12,715
Research and Development	11,975		11,975
Waste water collection and processing	7,931	1,322	9,253
Building cleaning (air pollution)	6,907		6,907
Natural area management	4,301		4,301
Associated activities	2,832		2,832
Total	319,942	91,342	407,191

Note: The totals have been rounded up and may not tally.

Source: Based on EOI, 2010.



employment are studied and quantified, which include the ecoindustry according to the 1999 definition in the aforementioned OECD/Eurostat Manual. On the other hand, research is also carried out on the possibilities of new, emerging sources of green employment in activities with high impact on employment in all economic sectors, which transcend the limits associated with traditional sectors.

In this first area, the report is supported, in the same way as the EOI 2010, by the classification put forward by OECD/Eurostat in 1999, which uses the term traditional activities. According to this approach, in 2009 green employment in Spain provided more than half a million jobs which were distributed as shown in Table 4.

Waste management and treatment provides jobs for the largest number of people, with more than 140,000 workers (26% of the total), followed by renewable energies, with 110,000 (21%), the waste water treatment and purification sector, with 58,000 jobs and the public sector, with 53,000 green jobs in 2009.

3.2. Evolution and regional distribution of green employment

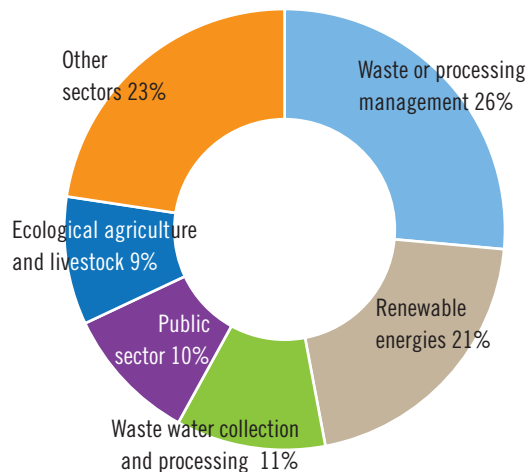
Stimates for green employment made by the Ministry for the Environment in 1998 estimated that a total of 219,382 persons were employed in environmental activities in Spain, representing 1.55% of the Spanish working population at the end of the last decade. Although this report and the FB and OSE 2010 study were conducted using different methodologies, some of the sectors analysed in both calculations are comparable and therefore show how green employment has evolved during the period. Comparable sectors are listed in Table 5.

The change experienced then and now in sectors where comparisons are possible is very significant. It grew from 158,500 jobs in 1998 to around 531,000 in 2009. This change represents an increase of 235%. The growth of jobs in renewable energies is significant. These increased by 3,005% or an equivalent rate of 37% per annum between 1998 and 2009.

Table 4. Distribution of green jobs by sector (FB and OSE, 2010)

	Jobs	%
Waste management and supply	140,343	26.4
Renewable energies	109,368	20.6
Treatment and purification of waste water	58,264	11.0
Public environment sector	53,072	10.0
Ecological agriculture and livestock breeding	49,867	9.4
Forest management	32,400	6.1
Environmental services to companies	26,354	5.0
Environmental R&D+i	21,929	4.1
Jobs in industry and services	20,004	3.8
Natural area management	10,935	2.1
Environmental education	7,871	1.5
Tertiary sector	540	0.1
Total	530,947	100.0

Source: Based on FB and OSE, 2010.

**Table 5. Green jobs in Spain (1998 and 2009)**

	1998	2009	Percentage variation
Renewable energies	3,522	109,368	3,005%
Treatment and purification of waste water	15,357	58,264	279%
Waste management and supply	37,226	140,343	277%
Environmental services to companies	6,100	26,354	332%
Environmental education and information	900	7,871	775%
Ecological agriculture and animal breeding	23,278	49,867	114%
Forest management	22,980	32,400	41%
Public environmental sector	43,308	53,072	23%

Source: FB and OSE 2010.

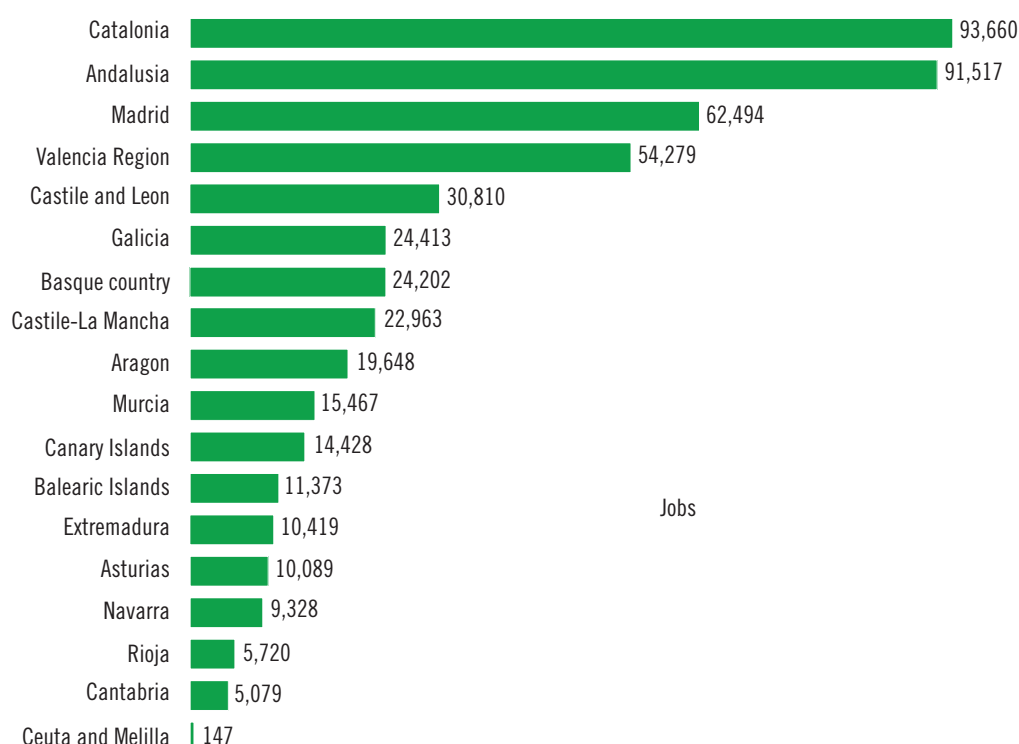
In terms of the weight of green jobs in total employment in the country, the change is also considerable. Considering the comparable information from 1998 and 2009 alone, it is shown that green employment has grown from 1.12% of total employment in 1998 to 2.81% nowadays.

In terms of the geographic distribution of green jobs, the figures show that 57% of all these jobs are in the autonomous regions of Catalonia, Andalusia, Madrid and Valencia. Graph 1 shows the regional distribution of green jobs in Spain.

The geographical perspective is even more accurate when regional distribution of green employment is compared with total employment and population. This comparison shows that greater progress has been made in some regions such as Catalonia, Navarre, La Rioja, Aragon and Castile and Leon, although for different reasons and with different consequences for creation of capacities and potential for future development. While in the first two, productive and knowledge generation and management activities are responsible for the great progress made with employment, in other cases they are driven by comparative competitive advantages and environmental demands (renewable energy plants, forestry and natural area management and ecological agriculture), or the relative weight of the public sector (FB and OSE, 2010).

3.3. Future prospects in the selected sectors

In the sectors analysed in this report which are construction, renewable energies, waste, basic industry and transport, there are estimates of the current level of employment and forecasts for future employment based on alternative hypotheses for expanding production. The main results are summarised in Table 6. A detailed analysis is presented in the respective chapters.

Graph 1. Green jobs in Spain by autonomous region

Source: Based on FB and OSE, 2010.

Table 6. Current and projected employment in selected sectors

	Estimated current jobs	Proyection for jobs year 2020	Measure evaluated
Renewable energies			
Total	148,394		
Direct	88,209	124,265	Share of renewable energies reaches 20% of primary energy production in 2020.
Indirect	60,185		
Sustainable transport (1)	843,500	122,000	Sustainable mode expansion plan.
Construction (2)	32,744	100,000	Building renovation plan will upgrade 565,000 homes per annum.
Resource management (3)	110,000	14,000	Introduction of a Deposit, Refund and Return System for beverage packaging (SDDR).

Notes: (1) Future jobs measured as a deviation from the scenario without introduction of the Plan.

(2) Current jobs refers to jobs on building renovation associated with energy efficiency measures.

(3) Projections to the year 2014. Future jobs measured based on the scenario without introduction of the System.

Source: Prepared by the authors.

As can be seen in Table 6, a significant number of jobs could be created in the coming years if measures to expand sustainable production are introduced. It is worth stressing that this was the dominant scenario towards late 2011, however a further evaluation is

pending to ascertain how these trends are being affected by the current recession, adjustment measures and changes to schemes to support the sectors involved, as will be explained in the sectoral chapters.

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4.1. Renewable energies

4.1.1. Environmental, economic and social impacts of renewable energies in Spain

Spain's renewable energy sector² has developed spectacularly over the last decade. Along with Brazil, China, Germany, India, Japan and United States it leads the world in renewable energy production using wind turbines, solar panels and other related equipment (REN21 2011). In Spain in 2010, 32.4% of electricity consumed (97,442 Ktoe) was generated using renewable sources. This is 30% higher than in 2009, when it produced 25%, in turn 6.5 points higher than the same measurement for the EU-27 in 2009 (IDAE 2011c and Eurostat).

Renewable energies represented 9.4% of the primary energy supply in 2009, and topped 12% in terms of final gross energy (Ministry of Industry, Tourism and Commerce, 2010). The power installed in all renewable sources stood at 44,247 MW and generation at 87,673 GWh. In both cases, wind and hydroelectric technologies count for over 86% (IDAE 2011a). In addition, renewable energies help

to prevent emissions of 29 million tonnes of CO₂ (CCOO Trade Union Confederation, 2010).

The direct contribution from renewable energies to Spain's GDP was roughly 7.339 billion Euros in 2009. This represents a real growth of 56.7% since 2005. The sector's indirect contribution reached 2.961 billion Euros in 2009, making the total contribution 10.283 billion Euros, roughly 0.98% of the GDP in Spain in that year (IDAE, 2011a).

Many different studies have estimated the number of workers in the sector. According to IDAE (Institute for Energy Diversification and Saving) states the number of workers in renewable energies in Spain in 2010 to be around 148,394, divided into 88,209 direct jobs and 60,185 indirect jobs (IDAE 2011c).

This work is largely regulated by the Renewable Energies Plan (PER) 2011-2020, drawn up by the Secretary of State for Energy through IDAE in 2011.

Once the previous Renewable Energies Plan 2005-2010 had expired, the PER 2011-2020 included the designing of new energy scenarios and incorporated targets in line with European Parliament and Council Directive 2009/28/EC, of 23 April 2009, related to promoting the use of energy from renewable sources. This Directive establishes binding minimum targets for the whole European Union and for each Member State individually. Specifically, it establishes a minimum 20% target for energy from renewable sources in final gross energy consumption in the European Union, the same target set for Spain and a minimum

² This category counts non-fossil renewable energy sources that according to Directive 2009/28/CE applied in Spain have been defined as solar, aero-thermal, geothermal, hydrothermal and ocean energy, hydro-energy, biomass, landfill gases and gases from purification plants.

10% quota of energy from renewable sources in energy consumption in the transport sector in each Member State for 2020.

The overall aims of PER 2011-2020 correspond to Europe-wide environmental standard targets (20% reduction of greenhouse gases, 20% improvement in energy efficiency, 20% gross consumption of energy produced by renewable sources).

Towards the start of 2012, however, Spanish authorities made changes to the standard in force and so an upset in trends might be envisaged for the sector in the near future.

Within the framework of tightening measures being carried out to realign growth in the Spanish economy, Royal Decree-Law 1/2012 suspended any procedures for pre-assigning income and eliminated any economic incentives for new electrical energy production facilities using cogeneration, renewable energy sources and waste. The measure springs from the need to control the sector's tariff deficit, added to the fact that installed power targets envisaged in the Renewable Energies Plan 2005-2010 for wind technology and solar thermoelectric and photovoltaic solar systems (BOE, 2012) had been exceeded in 2010.

According to sector estimations, this measure would affect 4,500 MW from wind power, another 250 MW from photovoltaic and above all, the industry linked to this activity. However, there will be no change for the pre-register wind power 1,600 MW as well as pre-registered solar thermal power 1,200 MW. In terms of employment, the Photovoltaic Industry Association (ASIF) warns that a sudden stop in installing new renewable power with an added bonus will destroy 10,000 jobs in the sector. Destroying jobs in the renewables sector might lead to industrial relocation and technology transfer to third

Although we might expect the sector's expansion rate to slow down in the short term, authorities stated that the measure does not compromise energy targets set for 2020³. Graph 2 shows targets set in the PER relating to renewable energy components that should be attained by the electricity, heating and cooling and transport sectors and the total share of

renewable energy sources within gross energy consumption.

As a global target, the PER 2011-2020 envisages that the energy share obtained from renewable sources should reach 16.7% and 20.8% in 2015 and 2020 respectively.

As previously mentioned, sector employment data can differ depending on the source being analysed but stands at around 100,000: 94,737 in the report by the Escuela de Organización Industrial (EOI, 2010) and 109,368 in the study by the Fundación Biodiversidad and the Observatorio de la Sostenibilidad en el Empleo (FB and OSE, 2010).

The latter report evaluates the employment progress over the decade as reports a measurement comparable with employment corresponding to 1998. In this year, 3,522 positions were recorded implying that employment grew by 3,005% in the period, or the equivalent of an annual average of 37% between 1998 and 2009. Out of all the sectors in the green economy, it has grown the most.

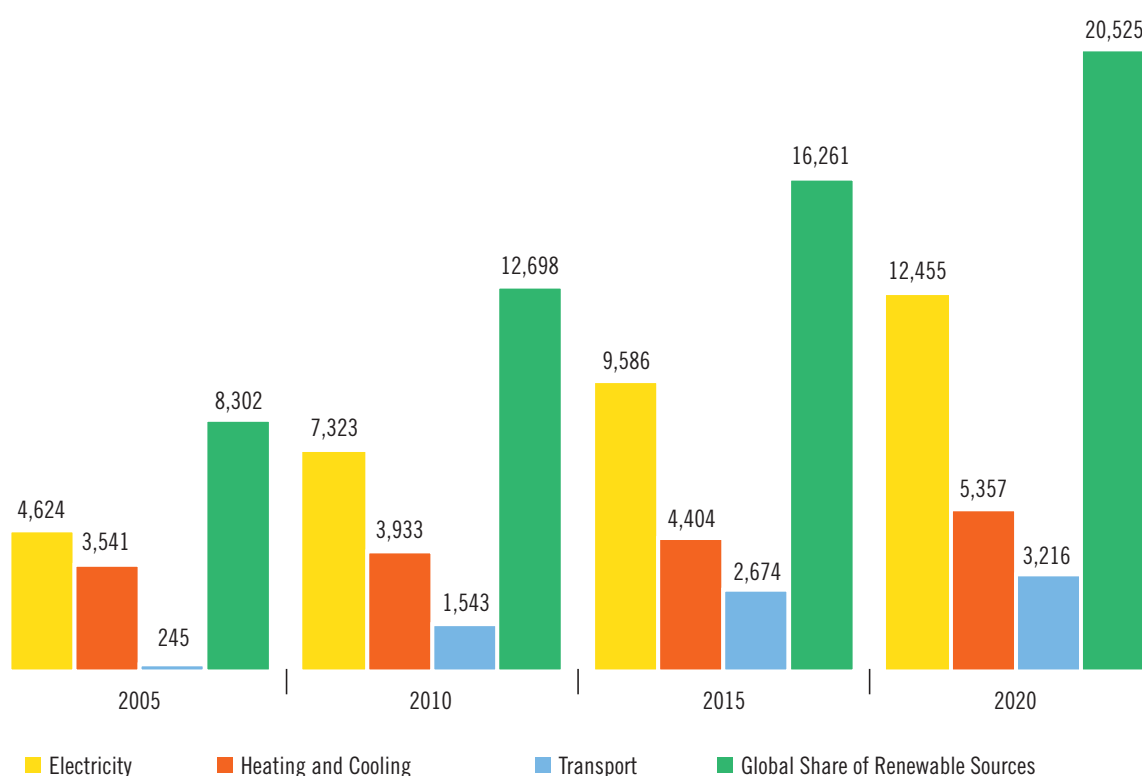
As far as the segment's unsustainable environmental impacts are concerned, the energy sector is largely responsible for all equivalent carbon dioxide (CO₂) emissions. In 2009, as a consequence of the economic recession and the greater penetration of renewables, the electricity sector demonstrated that its emissions volume was slowing down and growth was only 11.7% with respect to 1990, the base year. The percentage of emissions from this sector since 1990 has ranged between 22% and 25% of all the emissions. It dropped under 20% for the first time in 2009 (CCOO Trade Union Confederation, 2010).

Furthermore, the presence of oil and its derivatives in primary energy consumption in Spain is considerably higher than the European average. This fact, together with the low domestic energy production, practically centred in renewable energy resources, in nuclear energy –for which Spain imports 100% of enriched uranium used in the plants– and the small contribution from national coal, gives rise to an elevated dependence on foreign sources which is nearly 80% of total energy consumption (Ministry of Industry, Tourism and Commerce, 2010).

Faced with these challenges, Spanish energy policy has envisaged moving forward along three lines: increasing supply safety, making the economy more competitive and guaranteeing economic, social and environmental sustainable development.

³ These declarations appeared in different media, such as the online publication from the Provincial Association of Renewable Energy Companies (Asempal Renovables) on 9 March 2012, <http://www.asempalrenovables.es/>

Graph 2. Energy targets set in PER 2011-2020



Source: PER 2011-2020.

One of the strategies Spain follows –along with most industrialised countries– involves developing energy infrastructures and promoting renewable energies, energy saving and efficiency. Among the positive aspects for the whole society of renewable energies, the PER highlights the sustainability of its sources, reduction of contaminating emissions, technology change, the possibility of making progress towards distributed forms of energy, reduction of energy dependency and the deficit in the commercial balance and a rise in employment and rural development.

Further information on current employment characteristics and future employment forecasts and expectations is valuable for public policy.

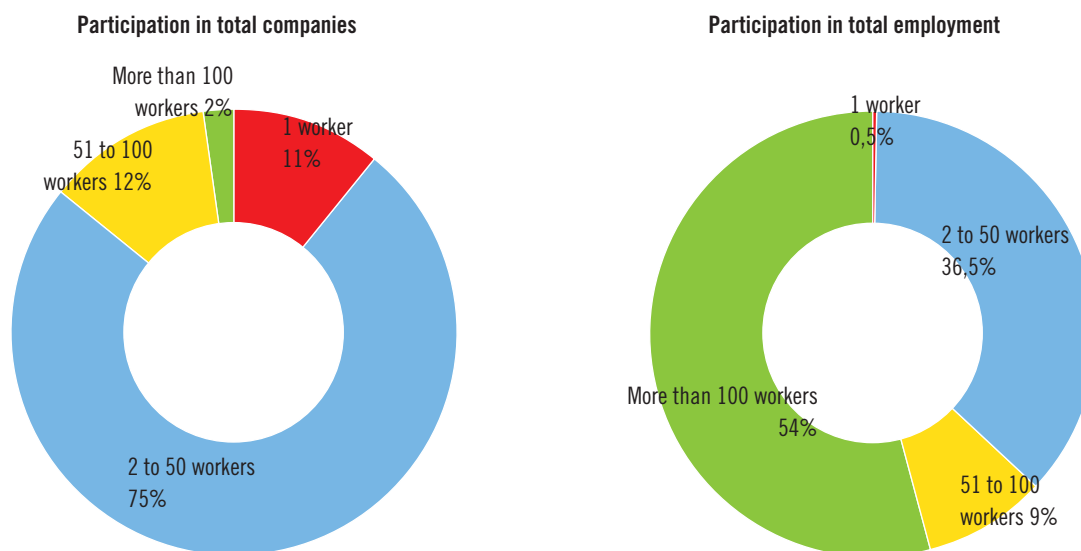
4.1.2. Employment in the renewable energies sector

The Spanish renewables sector is constantly being analysed and information available on the sector's

employment aspects is well developed and quantified. This category counts existing jobs in production, distribution, operation and maintenance of energy from renewable non fossil sources that, according to Directive 2009/28/EC applied in Spain, have been defined as wind, solar, aero-thermal, geothermal, hydro and ocean energy, hydraulic, biomass, landfill gases and gases from purification plants.

For analytical purposes, jobs can be classified into manufacturing and installation on the one hand and operation and maintenance on the other. The first group is related to the power installed over a period of time and the second to maintaining this installed power. The progressive increase in power installed in Spain is currently having a knock-on effect on employment associated with operation and maintenance. This employment is independent of any variations in implementation rates for new facilities and is defined with ever increasing accuracy; much of it involving specialised and qualified jobs. Jobs in this field of work represented 12.0% of the total in 2010 (ISTAS, 2010).

Graph 3. Participation in employment and in the companies according to company size



Source: Based on FB and OSE, 2010.

In the construction, installation and dismantling phase, many jobs are generated although only for a short period of time thereby creating many jobs that are only temporary. On the other hand, the service, operation and maintenance phase usually spans between 25 and 30 years generating a small yet very stable number of jobs, due to the fact that this work always needs to be done in these facilities. The more photovoltaic power is installed, the higher the demand for staff is (Navarro Alonso, 2011).

Regarding the business framework, the FB and OSE report (2010) estimates that the sector currently has 3,091 companies involved in manufacturing components, assembly, equipment installation and maintenance, heating and air conditioning and project design or energy generation. Photovoltaic solar energy represents 72% of the companies that work in this field while 63% of them work in the field of solar thermal energy. Companies frequently specialise in two or more renewable energy fields.

In terms of company size, there are more small companies (75% of the companies employ between 2 and 50 workers) although a small set of major companies provide the vast majority of employment. The relationship between the company's size and employment generated is shown in Graph 3.

Based on surveys carried out among more than 900 companies, the IDAE study shows a total of 28,537 sample jobs which, when extended to the business world, gives 70,152 direct jobs in the renewable energies sector. To calculate indirect jobs, we have to resort to multipliers used in a study by the Renewable Energies Producers Association (APPA).

Table 7 shows the direct jobs for each technology and their proportion of the total, the multipliers used to calculate indirect employment, indirect jobs and the total employment from the IDAE study.

The wind power area represents 37.2% of total jobs, photovoltaic solar 19.1% and solar thermal-electric power 10.1%. The other technologies make up 33.6% of total remaining jobs.

Regarding job multipliers, according to data for 2010, bio-fuel and electric biogas production are higher, followed by electric biomass. These multipliers reflect the sector's carryover effect on the rest of the economy as a result of purchases made by the sector where the increase in production originates. In 2010, for each job created in the bio-fuel sector and as a result of purchases in this sector over the rest of the economy, 1.03 jobs were created in the remaining sectors.

Table 7. Jobs in renewable energies by technology

Subsector	Direct employment	Indirect employment	Total employment	%	Multiplier
Wind	30,651	24,521	55,172	37.2	0.80
Photovoltaic solar	19,552	8,798	28,350	19.1	0.45
Solar thermal electric	9,346	5,608	14,954	10.1	0.60
Electric biomass	7,172	6,789	13,961	9.4	0.95
Thermal use biomass	5,754	5,640	11,394	7.7	0.98
Solar thermal	6,757	3,041	9,798	6.6	0.45
Common activities	4,262	2,718	6,980	4.7	0.65
Waste incineration	1,415	637	2,052	1.4	0.45
Bio-fuels	964	988	1,952	1.3	1.03
Hydro and mini-hydro	1,078	485	1,563	1.1	0.45
Electric and biogas	664	681	1,345	0.9	1.03
Geothermal	415	162	577	0.4	0.39
Ocean energy	74	38	112	0.1	0.51
Thermal use biogas	55	56	111	0.1	1.02
Solid Urban Waste + industrials - thermal	50	23	73	0.0	0.46
Total	88,209	60,185	148,394	100.0	0.68

Source: IDAE 2011 and author's source.

Note: Some studies that mentioned these results do not report the Waste incineration and the Others categories and so the consequent volume of employment is less.

The distribution of employment per activity is shown below (Table 8).

Table 8. Distribution of jobs per activity

Activity sector	Direct employment (%)
Equipment manufacture	37.6
Project and Service Development	18.3
Construction and Installation	16.9
Operation and Maintenance	12.0
Marketing, equipment sales	10.3
R&D+i	4.5
Total	100.0

Source: IDAE 2011.

Areas generating most employment are equipment manufacture, project and service development and construction and installation (16.9%). R&D+i activities contribute to employment with 4.5%. This field demonstrates that the renewable energy companies' contribution to the GDP outstrips the rest of the economy.

In the EOI estimation (2010), the jobs registered in the National Classification of Economic Activities

categories (CNAE by its) were counted totally or partially as explained below:

- Characteristic activities: 11,327 jobs

Category	Economic Activity
CNAE	
3515	Production of hydroelectric energy
3518	Production of wind electrical energy
3519	Production of other types of electrical energy

- Related activities: 83,410 jobs

Category	Economic Activity
CNAE	
2811	Manufacture of engines and turbines, except those intended for airships, motor vehicles and motorcycles
2812	Manufacture of equipment with hydraulic and pneumatic transmission
2229	Manufacture of other plastic products
2611	Manufacture of electronic components

2712	Manufacture of apparatus for electric distribution and control
2790	Manufacture of other materials and electrical equipment
3312	Machinery repair
7111	Technical architecture services

Finally, the 2010 FB report based on Ministry of the Environment data and estimations based on its field work by Fundación Biodiversidad are found in Table 9.

Table 9. Employment in renewable energies, 1998-2009

1998	2009	Percentage variation
3,522	109,368	3,005%

Source: Fundación Biodiversidad, 2010.

As indicated, the sector has an outstanding accelerated growth over the above period. This growth is perceptible in each of the sector's segments. This growth is exponential in some cases such as wind power that has almost 20 times more installed power than just nine years ago, going from 834 MW in 1998 to 14,934 MW in 2007. Expanding this area has generated a considerable number of direct and indirect jobs, associated with design, manufacturing and assembly of wind installations plus operation and maintenance tasks on wind farms (FB and OSE, 2010). Back in 2006, Spain was second only to Germany in terms of employment in the wind power sector (UNEP and others, 2008).

It is difficult to forecast how employment will change over the next few years because of the recession and regulations that have come into force in the last few months. It should be mentioned that just as sector expansion leads to creating direct, indirect and induced employment, a steep drop in investment in the sector and consequent withdrawal of renewable energy production projects will not only affect the industry's workers themselves but also the supply industries and it will generally reduce the level of spending in the economy.

Regarding the distribution of employment per Autonomous Community, data from the Fundación Biodiversidad show the distribution presented in Graph 4.

The Autonomous Community of Catalonia and the Community of Madrid focus the largest number of jobs in the sector (19% of the total each), due to

the fact that these two communities keep the largest amount of employment in Spain. Other communities with a high share of employment in renewable energies are Andalusia (12%) and Valencia (11%).

4.1.3. Jobs in renewable energies over the next few years

A set of studies has put forward a model hypothesis and proposal to estimate jobs in the renewable energies sector over the next few years. The prospective studies presented in this section use surveys, field studies and quantitative methodologies to predict future work positions in terms of quantity and other features. Although the results presented here were estimated in 2010 and 2011, and thus before Royal Decree-Law 1/2012 (introduced back in Section 4.1.1), the authorities have stated, and several sources have reiterated, that the measures do not compromise targets for renewables for 2020. For this reason, this report considers that the participation quota for renewables and the sector-based targets should be maintained.

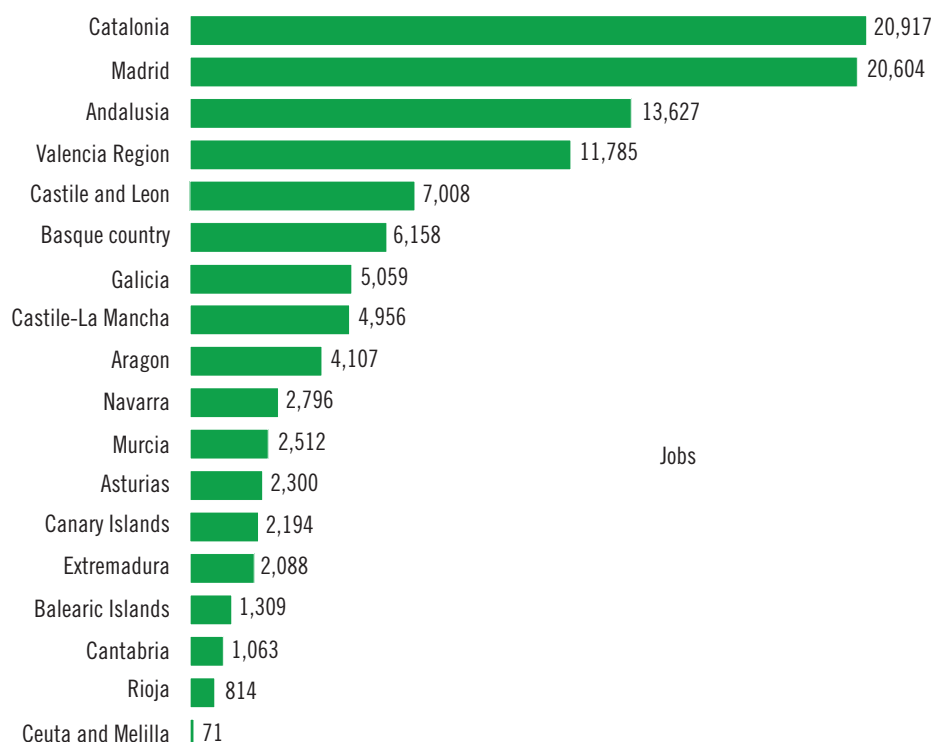
As far as probable future employment levels are concerned, forecasts from ISTAS (2010) are used. The study projects employment variables and a series of energy variables of interest and presents predictions for 2015 and 2020.

Three future scenarios (A, B and C) are considered for the estimation, differing in terms of the installed/accumulated power forecasts. Scenario A assumes that by 2020, 20% of primary energy production will be obtained using renewable energies. This is very similar to the target set in PER 2011-2020 for the national total⁴. Scenario B considers a more optimistic case where renewables will cover 30% of the primary energy production. Scenario C is more pessimistic; it contemplates falling short of both the Government's targets on installing power from renewable energies and the European Directive.

In order to obtain employment level estimations in the sector between 2015 and 2020, employment

⁴ Although the ISTAS study (2010) associated scenarios A, B and C with the targets set in the National Renewable Energies Action Plan (PANER 2011-2020), as these targets are similar to PER, this Report would rather refer to the PER that has already been approved.

Graph 4. Jobs in renewable energies by Autonomous Community



Source: Fundación Biodiversidad, 2010.

ratios were applied to installed power and accumulated power forecasts. The former are associated with jobs in manufacturing and installation and the latter with operation and maintenance.

In the estimations being analysed, employment ratios were obtained from the relationship between the employment level per technology in 2010 (obtained by means of company surveys) and the installed/accumulated power at the end of 2009. Table 2 shows the results of the estimations for 2020.

If 20% penetration of renewable energies was verified in 2020, the sector would attain 124,265 direct jobs, 81.5% more than existed in the base year. In terms of technologies, the greatest employment growth would be seen in the manufacturing and installation phase of solar thermal energy, 378%, as it is expected that this technology will manage to take off in the years to come.

If renewable energies get a 30% share of final energy consumption in 2020, over 200,000 jobs

would be created. The technology with the greatest growth will be photovoltaic, undergoing an increase of 296% in the projected period, due to installing distributed power on housing roofs. The weight of the wind power sector would remain significant due to setting up off-shore wind farms.

On the other hand, if renewables covered less than 18% of final energy consumption in 2020, the increase in employment would be 41%. The greatest contribution would be attributed to the photovoltaic sector and the wind power sector would undergo a net loss in jobs compared to the base year.

To sum up, according to estimations presented by ISTAS (2010), where direct jobs generated between now and 2020 are associated with the rate of power installation and accumulation, the envisaged range covers from 25,000 to 130,000 jobs.

These reports also state that renewable energies have a very important effect on energy supply safety as they help to reduce the risk of supply cuts in conventional fuels.

Table 10. Jobs in renewable energies by technology in 2020. Alternative scenarios

	Scenario A			Scenario B			Scenario C		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Wind	30,309	24,247	54,556	57,502	25,876	83,378	24,247	10,911	35,158
Hydro	5,983	2,692	8,675	4,217	1,898	6,115	4,807	2,163	6,970
Solar thermal	28,180	12,681	40,861	22,872	13,723	36,595	19,726	11,836	31,562
Solar thermal electric	2,093	1,256	3,349	4,426	1,992	6,418	1,674	753	2,427
Photovoltaic solar	47,527	21,387	68,914	95,431	83,979	179,410	38,022	33,459	71,481
Biomass	4,304	3,788	8,092	7,540	7,729	15,269	3,443	3,529	6,972
Bio-fuel	1,512	1,550	3,062	1,512	1,550	3,062	1,211	1,241	2,452
Biogas	3,927	4,025	7,952	6,277	2,448	8,725	3,142	1,225	4,367
Geothermal	430	168	598	2,987	1,553	4,540	301	157	458
Total	124,265	71,794	196,059	202,764	140,748	343,512	96,573	65,274	161,847

Source: Based on IDAE, 2010a.

Table 11. Impact of renewable energies on macroeconomic variables of interest. Years 2015 and 2020

Macroeconomic Variable	2009	2015	2020
Direct contribution to GDP (billions Euros)	7.339	9.903	13.065
Indirect contribution to GDP (billions Euros)	2.961	3.797	4.933
Total contribution to GDP (billions Euros)	10.283	13.700	17.998
Participation in GDP (percentage)	1.0	1.1	1.2
Commercial balance (billions Euros)	0.701	1.394	1.893
Contribution to R&D+i (billions Euros)	0.391	0.485	0.621

Source: IDAE, 2011b.

Other macroeconomic variables associated with the PER scenario

Working from the power installation and energy production targets for 2020, renewable energies' contribution to the Spanish economy was estimated for 2015 and 2020. Table 3 shows the projected values, including the control year to get a better view of the impacts.

In 2015 and 2020, the renewable energy sector's direct contribution to Spain's GDP would represent growth on the contribution recorded in 2009 of 28.2% and 66.6% respectively. Other favourable results include a positive and growing commercial balance and also a growing contribution to R&D+i.

In 2010, sector experts supported the quantitative predictions. Although the economic crisis introduced a degree of uncertainty reflected, among other aspects, in stagnation of the photovoltaic sector, in 2009 the vast majority of companies interviewed (70%) considered that their staff numbers would

remain stable. At the time of the study, 27% of all companies maintained a more optimistic future perspective, hoping that they would continue to grow, 2% of them even thinking that they would have strong growth for their company in the future years. This perception increased with the size of the company interviewed (ISTAS 2010). It is clear that the recession in Spain has worsened over the last two years, and so perceptions would be moving towards greater pessimism and uncertainty.

In a similar way, a Spanish National Employment Institute study (INEM, 2008) evaluating expectations for creating employment in the photovoltaic segment reported a positive outlook for installers, operators and technicians. This assessment was based on the positive legislative framework, by tariffs encouraging investment, easy access to project financing, non recoverable funds, fiscal incentives and explosive growth of the demand for photovoltaic solar energy installations to connect to the grid.

Table 12. Average annual salary, renewable energies (Euros)

	22 companies selected from renewable energies	Industrial sector	Spanish economy
Average annual salary (Euros)	32,816.79	23,942.55	21,638.86
Gap with industry total and economy total (%)		-27.0	-34.1

Source: Based on ISTAS 2010, working from the data obtained from reports for the selected companies from the renewable energies sector (Mercantile Register) and INE data.

It is pretty clear that expectations are no longer valid after the approval of the RDL 1/2012. It is precisely the photovoltaic sector that will be affected by the part of the projects that are still not pre-registered and it is envisaged that many projects will be withdrawn. In this respect, the Photovoltaic Industry Association (ASIF) has warned that a halt in the installation of new renewable power with incentives will destroy 10,000 jobs in the sector.

In this context, it might be expected that all segments of renewable energies, from wind power to solar thermal and biomass, would suffer job losses. This loss has been estimated at 20,000 by the Renewable Energies Foundation (FER).

4.1.4. The quality of the jobs generated in renewable energies and the just transition

In general, jobs in the renewable energies sector demonstrate better indicators than the rest of the energy sector or the average for the whole economy. There is evidence for Germany and Spain that jobs in renewable energies are predominantly permanent and full-time positions with only a small share of temporary work contracts. Other sectors in these countries, on the contrary, rely to a much greater extent on temporary workers (Wissenschaftsladen Bonn, 2010; Strietska-Ilina, O. et al; 2011). Studies in both countries also indicate that qualification levels among workers in this sector considerably exceed average qualifications among the general work force in the economy, in terms of university degrees, vocational education and levels of training (EC & ILO, 2011).

The characteristics of renewable energy jobs in Spain were analysed by ISTAS (2010) drawing the following conclusions:

A considerable difference is highlighted between male and female participation in the sector. Only 26.6% of workers in renewable energies companies are women and 73.4% are men. These figures stand at 44.3% and 55.7% respectively for the economy as a whole in 2010. In the analysed sector, the distribution of female workers by department reproduces to a large extent what is happening in the industrial sector: almost 64% of jobs are in the administration department. They are least represented in jobs related to industrial production and installation.

As has been observed the predominant type is an fixed term contract (83.7%). This category is followed, by temporary contracts (14.1%), job-placement training/internship contracts (0.9%) or self-employed worker contracts (1.2%). It should be highlighted that the practice of subcontracting seems to be making inroads into the sector. As has occurred in other sectors in the economy, a greater number of intermediaries in the production chain make it difficult to apply control mechanisms and employers' responsibilities tend to weaken. It is these companies –that do not fall within the scope of the study– that probably offer the poorer quality jobs.

The average salary from the companies analysed stands at 32,817 Euros, 52% higher than the national average and 37% higher than the average salary for industry, entirely consistent with the higher qualification of the sector's workers, their greater productivity, R&D+i contribution and export trend. The average salary in the companies analysed is higher than the renewable energies sector average as small companies are left out of the study.

Table 12 summarises the relevant values.

4.1.5. Final comments

Over the last few years, the renewable energies sector in Spain has undergone enormous development. Although the trend tends to slightly swing, the sector's contribution to GDP and the employment market has shown a tendency to grow over the last few years. This process has some exceptions for specific technologies, such as photovoltaic, where the number of workers dropped over the last year. The renewable energies sector has the best employment growth of the green economy in the last decade. Future employment perspectives are generally good although this expectation should be considered within the economic context of the current recession the country is experiencing. Depending on the expansion targets for the renewable energies sources that set a quota of 20% for 2020, different methodological approximations project growing employment in the sector. According to this scenario, numbers will range between 160,000 and 340,000 jobs created up to 2020.

Although official employment projections have not yet been revised, it is clear that these trends might be affected as a result of the Royal Decree-Law 1/2012 coming into force. To date, estimations used come from the sector, forecasting a drop of 10,000 jobs in the photovoltaic segment and 20,000 in the whole sector.

The sector is composed of a set of predominantly small companies although the larger companies provide most of the jobs. Areas that generate the most employment are equipment manufacture, project and service development and construction and installation. The qualification levels required among the sector's professions vary widely, from high levels of qualification to develop projects to lower qualifications to manufacture components.

Decent work indicators suggest that working conditions for jobs in renewable energies are generally better than average for the economy or for industry. Higher salaries and a high incidence of permanent contracts are an example of this. From the gender perspective, there is a worrying underrepresentation of women among all workers, far below the economy's average. The spread of outsourcing would indicate the existence of lower quality jobs that have, however, not been compiled in the empirical studies available.

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4.2. Transport

4.2.1. The environmental, economic and social impact of transport in Spain

The contribution of transport to national wealth is estimated at 5% of Spain's Gross Value Added, with some variations in this trend reported during the 2000-2005 period (CEOE 2009). In terms of energy consumption and greenhouse gas emissions, this sector exhibits a rather unfavourable

performance in contrast with the average target values currently in place for the European Union. Within the total energy consumption values, transportation in Spain consumes, in average, almost ten points more than the European average, and this disparity has remained steadily in place during the last few years (Economics Office of the President of the Government, 2009). In 2010, from the sector's total energy consumption of 1.8 million terajoules, each transport modality contributed the following amounts as expressed in Table 1 and Graph 1:

In the same way, Eurostat statistics for the last two decades indicate that the sector's contribution to total CO₂ emissions in Spain is more than eight percentage points higher than the EU-27 average. Recent estimates for the country's total CO₂ emissions suggest that in 2010 these modalities contributed to total CO₂ emissions in the following proportions (Table 13 and Graph 2).

The incidence of negative effects concerning transport, such as environmental pollution, accidents and road congestion, is particularly high for Spain. According to studies by INFRAS-IWW⁵, it is estimated that they might reach around 7% of the GDP, slightly below the European average (which is

⁵ This study to evaluate the external costs for transportation in the year 2000 and its subsequent updates were commissioned by the International Railroad Union (UIC) and the Community of European Railroad Companies and Infrastructure (CER) to the research team composed by the Swiss consulting firm INFRAS and the IWW Institute of Karlsruhe University in Germany.

Table 13. Energy consumption of the different transport modalities in Spain, in terajoules

Modalities	Terajoules	%
Road	1,254,501	67.5
Rail	12,552	0.7
Air	228,452	12.3
Maritime	362,473	19.5
Total	1,857,978	100.00

Source: Ministry for Development, 2011.

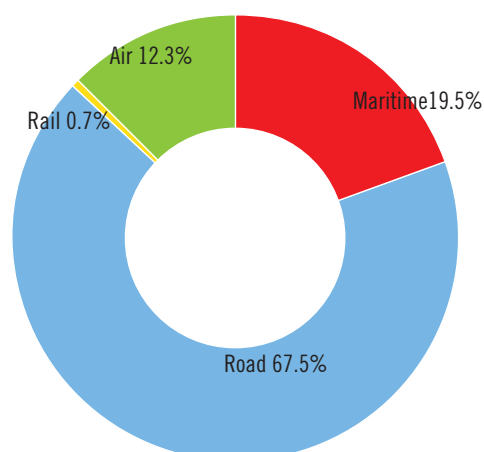
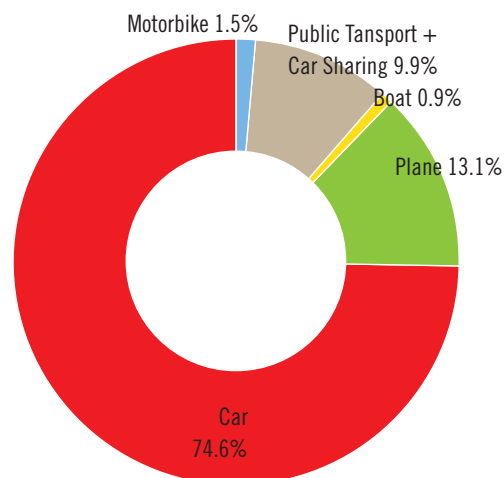


Table 14. CO₂ emissions in transport in Spain, in terajoules

Modalities	Tonnes of CO ₂	%
Car	25,500,841	74.6
Motorbike	511,867	1.5
Public Transport + Car Sharing	3,386,479	9.9
Boat	324,368	0.9
Plane	4,475,112	13.1
Total	34,198,367	100.00

Source: Empleaverde Programme, 2010.

**Table 15. Modal split of passengers and freight**

	Travellers (billion traveller/km)	Modal shift (%)	Freight (billion tons-km)	Modal shift (%)
Road	395.332	90.5	272.730	85.3
Rail	22.908	5.2	7.872	2.5
Air	17.342	4.0	39.090	12.2
Maritime	1.482	0.3	49	0.02
Total	437.064	100.0	319.741	100.0

Source: Ministry of Public Works, 2011.

estimated to be around 8%-9% of the EU member states' GDP, according to the European Environmental Agency). The most important element within the external costs is air pollution, followed by climate change and accidents. Road congestion, which is of lesser importance in the overall picture, is the most important externality within the entire European urban environment (FB and OSE, 2010). Recent estimates suggest that in 2010 the external costs of transport in Spain could have reached 31.1 billion Euros, a cost which is broken down by contribution in the following manner: vehicles (83.3%), ground public transport in addition Car Sharing (7.9%), motorbikes (4.4%), airplanes (4.3%) and boats (0.1%) (ISTAS-Fundación Conde del Valle de Salazar, 2010).

Throughout 2010, the trend towards the unbalanced distribution of transport modalities for both passengers and freight is still present. Transport growth is still leaning towards roads and aviation instead of towards rail and maritime transport,

fostering and developing the least efficient transport modalities from an energy-costs-saving as well as environmental point of view. The modal distribution of passengers and domestic freight traffic can be seen in Table 15 (which refers exclusively to interurban transport).

With regard to transport of passengers and domestic freight traffic, road transport was the preferred mode of transport for the year 2010, used by 90.5% of the billion traveller-km and to transport 85.3% of the billion tons-km of merchandise. In turn, concerning the transport of passengers, 86.4% travelled via private vehicle, 12.8% by bus and less than 1% by motorbike (Ministry of Public Works, 2011).

Concerning the automotive industry, the Spanish Association of Car and Truck Manufacturers (ANFAC) has determined that vehicle manufacture is one of the foremost sectors of the domestic economy, also generating around a quarter of all Spanish foreign sales. According to this entity, this

sector contributes to 3.6% of the Spanish GDP, or even 6.2% if the components subsector is taken into account. With regard to employment, the sector's total employment –both direct and indirect– amounts to over 9% of the labour force (ANFAC, 2011).

The transport system in Spain (infrastructure and vehicles) is a crucial determining factor when ascertaining competitiveness and the overall performance of the economy. The sector is essential to job creation and to the calculation of several aspects of the GDP. Nevertheless, its energy dependence, the high pollution costs it requires to operate and the sizeable external costs it creates, as well as its users' preference towards the use of private vehicles and the use of roads for domestic freight transfers, have all contributed to the introduction of unsustainable trends which in turn have created environmental, economic and social burdens.

During the last few years Spain has designed a set of strategies, policies and programmes geared towards counteracting the environmental impact caused by several sectors of the economy. One of these is transport, for which the key drivers in the process to offset the environmental footprint have been the following initiatives⁶:

- Transport Infrastructures Strategic Plan (2005-2020). Ministry of Public Works.
- Renewable Energies Action Plan 2005-2010. Ministry of Industry, Tourism and Commerce. Institute for Energy Diversification and Conservation-IDAE (2005).
- Spanish Climate Change and Clean Energy Strategy 2007-2012-2020. Ministry for the Environment, Rural and Marine Affairs.
- Spanish Sustainable Development Strategy. Ministry of the Presidency (2007).
- Strategic Plan for Energy Conservation and Efficiency 2008-2011. Ministry of Industry, Tourism and Commerce. General Secretariat of Energy (2008).
- Spanish Sustainable Mobility Strategy. Ministry for the Environment, Rural and Marine Affairs (2009).

- Spanish Urban and Local Sustainability Strategy. Ministry for the Environment, Rural and Marine Affairs (2009)
- Sustainable Economy Act (2011)

It is not clear what the future beholds. The areas that will go under cuts have not been reported as of this moment, therefore no predictions can be made concerning the future performance of the transport system, or the employment level in this particular sector.

4.2.2. Companies in the transport sector

The business structure concerning the manufacture of motor vehicles, trailers and semitrailers can be seen on Table 16.

In the year 2011, the sector was composed of 2,075 companies, almost half of which were also involved in the manufacture of vehicle parts, components and accessories. It should be clarified that according to the same source, the amount of companies in this sector was of 2,375 in 2008, connoting in part the impact of the economic crisis. The manufacturers' association estimates that both production and registration are positioned at a lower level than expected for the country given its level of development and its productive capacity. Specifically, on a yearly basis, there have been 600,000 less vehicles produced and some 750,000 less vehicles registered (ANFAC 2011) since 2008.

With regard to public transportation and collective passenger transport as well as freight transport, in 2011 all three modalities totalled together 190,000 companies⁷. It should be mentioned that 65.6% of the records concern companies specializing in Freight transport and relocation services, while 34.0% of the companies were categorized as “other passenger ground transportation”. This means that practically 100% of the companies belong to the road transport modality. In a far lesser order of magnitude, these are followed by maritime passenger transport, air passenger transport, maritime freight transport and other categories of this sector (Table 5).

⁶ For a detailed discussion of labour aspects concerning these measures see chapter on Labour Dimension.

⁷ Including Legal persons, Public limited companies, Limited liability companies and Other legal forms.

Table 16. Companies engaged in the manufacture of motor vehicles, trailers and semitrailers

Absolute values	Total	Without employees	1 to 2	3 to 5	6 to 9	10 to 19	20 to 49	50 to 99	100 to 199	200 to 499	500 to 999	1,000 to 4,999 or more	5,000 or more
Manufacture of motor vehicle, trailers and semitrailers	2,075	418	371	307	240	246	191	98	99	66	26	8	5
Manufacture of motor vehicle	192	74	40	21	14	14	10	8	1	1	0	4	5
Manufacture of bodies for motor vehicles, manufacture of trailers and semitrailers	881	164	199	181	124	115	68	12	14	4	0	0	0
Manufacture of parts, components and accessories for motor vehicles	1,002	180	132	105	102	117	113	78	84	61	26	4	0

Source: Prepared by the authors based on DIRCE (INE, 2011).

Table 17. Companies engaged in public transportation and collective transport (passenger and freight)

CNAE 2009 Category	Number of companies	Participation (%)
Freight transport by road and relocation services	124,558	65.6
Other passenger ground transportation	64,563	34.0
Maritime freight transport	266	0.1
Air passenger transport	192	0.1
Maritime freight transport	158	0.1
Air freight transport and special transport	79	0.0
Inland waterway passenger transport	64	0.0
Pipeline transport (1)	39	0.0
Rail freight transport	33	0.0
Inland waterway freight transport	8	0.0
Interurban passenger rail transport	7	0.0
Total	189,967	100.0

(1) Pipeline transport is used to transport gases, liquids, solids or multiphase.

Source: Prepared by the authors based on DIRCE (INE 2011).

Concerning the size of enterprises, calculated by number of workers, it is observed that for all three transport modalities companies tend to not register their employees, reaching participations of 60%, 50% and 31% respectively for the transport modalities –land and pipeline, air and maritime– with regard to this category (Graph 5).

4.2.3. Green jobs in the transport sector

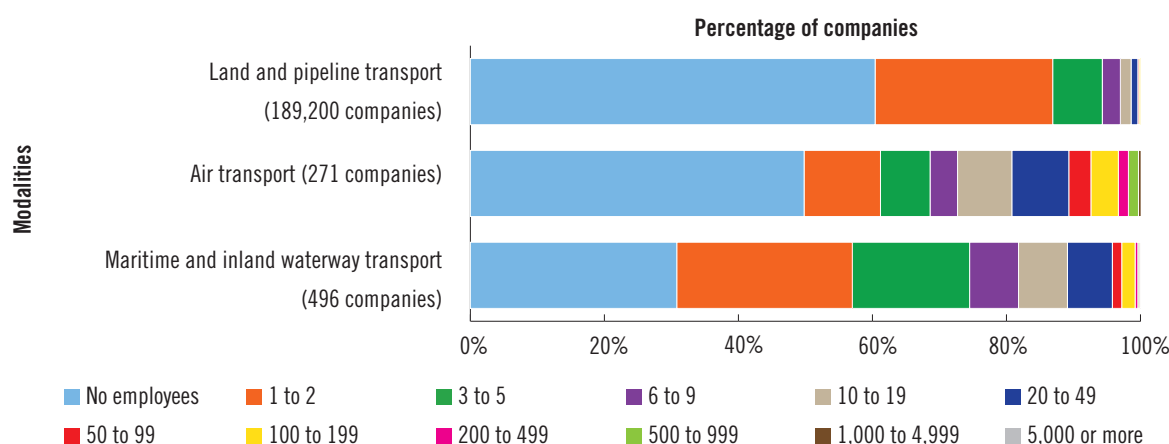
Green jobs in the transport sector are the result of the application of sustainable mobility policies which have created employment characterized by decent

working conditions. Opportunities for the creation of green jobs in the transport sector can be found at the heart of the main aggregates of production such as sustainable mobility planning, encouraging the development of quality public transport and improving vehicle efficiency.

Taking into account the definition put forward by the UNEP/ILO/IOE/ITUC *Green Jobs Report* (2008), within the transport sector, the sustainable subsector would be represented through the employment created by the development of:

- Vehicles with reduced fuel consumption.
- Hybrid-electric, electric and fuel cell vehicles.

Graph 5: Size of enterprises according to their number of employees



Source: Prepared by the authors based on DIRCE (INE, 2011).

- Car-sharing vehicles.
- Public transportation.
- Non-motorized transport (introducing alternatives such as bicycles, walking) and changes to policies regarding land use and settlement patterns (to reduce travel distance and dependence on motorized transport).

The same *Green Jobs Report* points out that although these occupations contribute to the reduction of the environmental footprint of economic activity, the reduction is gradual and all occupations contribute in equal measure. Workers that manufacture hybrid vehicles or vehicles with reduced fuel consumption contribute to the reduction of the resulting transport emissions to a lesser extent than public transport employees (UNEP/ILO/IOE/ITUC, 2008).

In terms of employment within the public transport sector, most analytical calculations qualify it as green employment. Data released by the Spanish Ministry of Public Works indicates that in 2010, the public transport sector in Spain employed 843,500 workers, a value equal to 4.5% of the working population⁸. Nevertheless, this classification is rather

broad and –in order to truly determine the existence of so-called green jobs– could benefit from a closer look at the sustainability subsector.

In the case of Spain, there is evidence that additional measures, particularly those oriented towards increasing the energy efficiency of the vehicle fleet, would have a positive environmental impact and would prompt job creation. The average greenhouse gas emissions per vehicle, although significantly reduced from 174 g CO₂/km in 1996 to 152 g CO₂/km in 2007 –that means a lower level of emission than the average EU-15 member states–, still has much room for improvement before being lowered below 120 g/km target, that corresponds with the goals set by the EU for 2012 (FB and OSE, 2010). Twenty per cent of the oldest fleet is responsible for eighty per cent of the pollution generated, which means that the renovation of the fleet or at least part of it, would represent higher energy savings and help preserve jobs (ANFAC, 2011b).

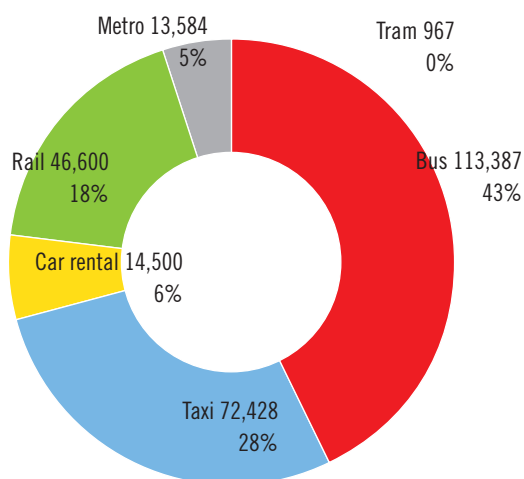
A report by the Fundación Conde del Valle de Salazar (2010) presents a comprehensive assessment of direct employment generated by the sustainable transport sector in Spain. The report presents the data obtained through the use of three successive approximations. The first one gathers all existing jobs within the modality of passenger transport managed by a public authority that report an average or

⁸ See Working Age Survey, National Statistics Institute (INE).

Table 18. Employment in sustainable transport, 2003-2008

	2003	2004	2005	2006	2007	2008	Variation 2003 - 2008 (%)
Rail	57,300	55,600	54,800	51,600	44,200	46,600	-18.67
Metro	8,285	10,065	10,581	11,049	12,826	13,584	63.96
Tram	-	189	242	277	742	967	-
Bus	100,219	98,778	104,161	102,663	107,658	113,387	13.14
Taxi	70,278	71,359	66,751	70,201	71,495	72,428	3.06
Car rental	12,700	13,700	12,800	14,600	15,500	14,500	14.17
Total	248,782	249,691	249,335	250,390	252,421	261,466	5.10

Source: ISTAS-Fundación Conde del Valle de Salazar, 2010.

Graph 6. Modal shift in employment generated by sustainable transport, year 2008

Source: Avilés C. et al., 2010.

low/null energy consumption. In this way, 261,466 jobs within all transport modalities (rail, metro, tram, bus, taxi and car rental) were recorded for 2008. The same data was used for the estimations for all years included in the 2003-2008 period. Table 18 indicates the estimated values for this period while Graph 6 presents the modal distribution for employment in 2008.

The second approximation presents a methodological improvement by also counting the jobs generated by the use of modalities typically excluded from the calculation, such as bicycles and car-sharing, in addition to some indirect jobs such as those concerning regulated parking and mobility management. This second calculation of employment results in a value of 281,887 jobs. Finally, the application of multipliers to the calculation of indirect employment within the different segments of public transport produces a

Table 19. Jobs in sustainable transport, different approximations

	1st Approximation	2nd Approximation	3rd Approximation
Total jobs	261,466	281,887	297,109
Increase (%)		7.8	5.4

Source: Avilés C. et al., 2010.

Table 20. Jobs in sustainable transport

Sector	N. of jobs
Sustainable transport services	200,000
Manufacture of railway equipment	
Construction naval civil Civil shipbuilding	50,000
Manufacture of low-emissions vehicles	85,000
Efficient construction of infrastructures	230,000
Total	565,000

Source: Economics Office of the President of the Government, 2009.

third value for employment in the sector of sustainable transport, which amounts to 297,109 jobs. The results of the proposed approximations can be visualized in Table 19.

Furthermore, the Fundación Biodiversidad reports employment data within the sector of sustainable transport. In this case, data concerning indirect employment associated to the expansion of the trend towards lower energy consumption is offered, and it provides a figure associated to the production of low-emission vehicles. According to the report, in 2009 there were approximately 560,000 direct and indirect green jobs within the sector of sustainable transport. Their distribution is shown in Table 20.

Both sources shed light on the magnitude of the sustainable sector and estimate the amount of green

Table 21. Transport in 2020 according to alternative scenarios

	Base Year 2010	Trend Scenario	Energy Efficiency
Total mobility in Spain (billion traveller-km)	398.841	433.960	403.831
Participation in sustainable transport (%)	19.8	21.0	30.9
Employment generated by sustainable transport (jobs)	281,887	321,614	443,870
Energy consumption (terajoules)	802,605	828,574	700,411
External transport costs (Euros/traveller-km)	0.078	0.077	0.071
CO ₂ Emissions (g/traveller-km)	85.7	85.9	77.6
NO _x Emissions (g/traveller-km)	0.279	0.293	0.279

Source: Prepared by the authors based on Avilés C. et al., 2010.

jobs in existence. The disparities between these reports are caused by the difference in the aggregate data considered as well as the different estimation methodologies used.

Within the framework for sustainable transport, using electric cars implies an attractive option in terms of quality of life. The promotion of battery-powered electric vehicles with zero local emissions and limiting pollution are both essential in order to generate electricity outside the city, where its impact can be mitigated through the use of renewable energy sources as well as controlling and reducing the emissions of the production centres. Besides being more efficient than combustion engine vehicles, electric vehicles offer additional benefits such as reduced noise emissions and, given their mechanical simplicity, greater reliability and lesser maintenance needs (Alonso, J., 2009).

According to WWF, in Europe, some 150,000 out of a total of 2 million jobs in the automotive industry can be considered green jobs. This conclusion is reached if vehicles that emit less than 120 grams of CO₂ per kilometre are considered. It is estimated that 7.5% of new vehicle sales in 2004 were of efficient, low-carbon emission vehicles, and said percentage is also applied to the industry's workforce. Furthermore, employment within the rail sector is estimated at 900,000 and employment in urban public transport reaches a similar scale (WWF 2009).

4.2.4. Green jobs in the transport sector over the next decade

Based on the data from 2008 and in line with the supposed expansion of the service for the 19 transport modalities selected, a study was carried out

by ISTAS, projecting future employment levels and other key variables of the sector for the year 2020. These projections are obtained according to two alternative expansion scenarios for transport services.

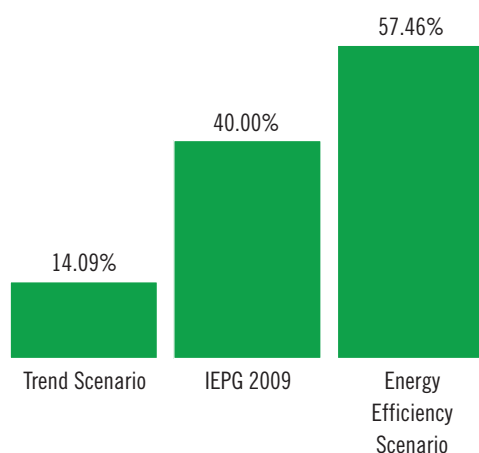
The so-called trend scenario assumes that the variables are consistent with the observed trend. The transport modalities with high energy consumption continue dominating travel distribution. The Energy Efficiency scenario assumes that the medium and low/null energy consumption modalities expand relatively more than the high energy consumption alternatives. For example, while for narrow gauge railway lines (FEVE) the Trend scenario projections are that for the 2010-2020 decade there will be a 1.8% annual increase and a cumulative 19.2%, it is hoped that for the Energy Efficiency scenario said values would reach 3% and 34% respectively. The figures obtained for the projections are summarized in Table 21.

The other model developed by the Empleaverde Program predicts that towards 2020, the Energy Efficiency scenario will have generated 122,000 more jobs than the Trend scenario. Furthermore, the entirety of the transport modalities will consume 15% less energy and CO₂ emissions measured in grams per traveller-kilometre will be 10% lower. The improved performance in regards to energy and emissions is a result of the increased participation in sustainable transport, which covers 30.9% of the total for mobility, and in doing so, places itself 10 percentage points above the corresponding value for the Trend scenario.

Concerning the volume of employment, although mobility is reduced for the Efficiency scenario, the incidence of public transport increases.

The Fundación Biodiversidad (2010) states that employment could increase by 40% by 2020 within

Graph 7. Employment in sustainable transport for 2020.
Alternative scenarios



Source: Prepared by the authors.

the field of sustainable transport, from the current 560,000 jobs in place all the way up to 770,000 jobs in diverse categories such as services, industrial activities and construction of infrastructures. Once again, this information focuses on indirect employment.

Graph 7 shows the range of values among which the increase of employment during the next decade could be situated, according to the aforementioned scenarios.

Concerning projections of a qualitative nature, a study carried out by the School of Industrial Organization (EOI) asked key informants in the sector about their expectations regarding three hypothetical measures: better preventive maintenance of infrastructures, vehicles and equipment; the incorporation of intelligent transportation systems (ITS) and services (car sharing, on demand, non-motorized) and the development of new ecological and efficient vehicles.

With regard to job creation, the expectations are moderate towards the support measures for the preventive maintenance of infrastructures and the incorporation of ITS systems and services. In both cases, the employment that could be generated will be of an average level for workers possessing advanced qualifications and of relatively low level for less qualified professionals.

However, a high level of job creation for workers with advanced qualification and a medium-high level for lesser qualified professionals is expected for the development of electrically-powered vehicles.

Therefore, the development of new alternative vehicles, better than those available in the present-day market, is a considerable employment niche for active population workers holding all types of qualifications.

For the three measures researched, respondents considered that the critical factor is the economic one, followed by the political factor. Technology is mentioned in relation to ecological vehicles, whereas social factors acquire importance when it comes to the introductions of ITS systems and services.

4.2.5. The quality of jobs created in the sustainable sector and just transition

In 2006 the transport sector in Spain was formed by 88% male workers and 12% female workers. Taking into account the whole economy, while figures for the average economy were of 60% male and 40% female for that same year (data obtained from the Ministry of Employment).

Concerning the predominant recruitment pattern within the sector, part-time employment reached 5.9% in 2006, denoting a sharp increase during a ten-year period, given that in 1995 it was of 3% (European Agency for Safety and Health at Work, 2011).

As was previously observed (see Graph 5), an important number of companies within the sector—such as those involved in collective or freight transport—are microenterprises and are formed by one or two people. In 2011, more than a quarter of all companies involved in ground transport, transport via pipelines, maritime transport and inland waterway transport reported 1 to 2 employees. With regard to air transport, the same applies to 11.4% of all companies (data obtained from INE, based on DIRCE).

Accident rates within the transport sector are typically high. According to Eurostat, during the 2000-2007 period, 19.3% of all fatal accidents are attributed to the transport, storage and communications sector in Spain (surpassed only by the construction sector). Incidence is much lower when one looks at labour accidents resulting in a leave of absence lasting four or more days. In this case, between 2000 and 2007, the average displayed by this sector was of 6.1% of total accidents.

Among the most common dangers and health risks for all workers in the transport sector are:

Table 22. Yearly salaries for the transport and storage sector, and wage gap (Euros)

	Both genders	Men	Women	Gender gap
Total economy	22,511.47	25,001.05	19,502.02	-22.0%
Transport and storage	22,196.86	23,073.94	19,262.12	-16.5%
Sector gap	-1.4%	-7.7%	-1.2%	

Source: *Wage Structure Survey, INE.*

exposure to noise and vibrations, holding static postures for an extended period of time, working in confined spaces, inhaling vapours and gases, handling dangerous substances, exposure to climatic conditions and changes in temperature, as well as the lack of a sufficient margin to adapt to more ergonomic working conditions and to a healthier lifestyle (European Agency for Safety and Health at Work, 2011).

The information concerning salaries within this sector was obtained from the INE's Wage Structure Survey. The latest data available is for 2009, and is shown in Table 22.

In short, jobs within the sustainable transport sector are affected by certain decent work deficits. Decent and quality employment must become an intrinsic characteristic of the promotion of green jobs in a new sustainable economy. Social gaps must be reduced, such as those resulting from low salaries, while guaranteeing the safety of all workers (Fundación Biodiversidad, 2010). The road towards a sustainable economy with a high percentage of green jobs cannot forget these aspects (Torres, 2009).

4.2.6. Final considerations

Sustainable transport in Spain has been backed up by the support of public policies. Within this context, the country is already able to quantify a significant number of green jobs.

More than 800,000 jobs have been created by the public transport modalities only. This amount includes the transfer of both freight and passengers via rail, other ground transport, maritime transport, inland waterway transport and air transport, besides other supporting transport activities. According to most estimates, all these jobs created would effectively be green jobs. If a more restrictive definition is considered the result is a lower figure for green jobs.

Taking into account exclusively passenger transport, 261,466 jobs have been recorded within the sustainable transport sector for the year 2008 (Fundación Conde del Valle de Salazar, 2010). This category includes travel via rail, metro, tram, bus, taxi and car rental.

On the other hand, Fundación Biodiversidad (2010) has reported that within the sector of sustainable transport, employment could increase by about 40% by 2020, from the current 560,000 jobs up to 770,000 jobs in the fields of services, industrial activities and construction of infrastructures. This measurement focuses on indirect employment.

According to the projections analysed, by 2020 the availability of green jobs in this sector could increase between 40,000 and 162,000 in relation to the values for 2010 (or 14% and 57%) depending on the level of progress for the use of medium and low/null energy consumption modalities out of total mobility. These aforesaid scenarios correspond to the hypothetical participation in sustainable methods by 21% and 31% respectively.

Concerning a group of measures that could be implemented, the expansion of public transport modalities for passenger transfer and an increased participation of more efficient methods, from the environmental and energy-efficient perspectives, for freight transfer –such as in rail and boat transport– could fulfil the ultimate goal of creating more green jobs. The development of electricity-powered vehicles based on the production of electricity with renewable energy sources presents itself as an option with excellent prospects for the creation of future jobs, according to experts in the sector and to the data reported in specialised studies.

As for the quality of jobs in the transport sector, the disparities in the gender gap as well as the continuing health and safety risks that workers in this sector face, continue being the main reasons of the decent work deficit. A series of measures geared towards improving the preparation of the workers,

including professional training, could possibly improve the working conditions of hundreds of thousands of workers, representing a significant achievement in the form of just transition, which is right on the road towards sustainable mobility.

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4.3. Basic Industry

4.3.1. Economic, social and environmental impact of basic industry in Spain

In 2009, the industrial sector accounted for just over 15% of the economic activity in Spain. This figure is below the 18% EU average and well below 22% in Germany, but similar to France, Italy and the United Kingdom (Economic Office of the President, 2010). Between 1999 and 2009 there was a 6 point decrease in the portion of the Spanish economy represented by the industrial sector. According to the United Nations Industrial Development Organization (UNIDO), this is the tendency in all industrialised countries (UNIDO, 2012).

Table 23. Persons employed in the industrial sector, in thousands

	2008	2009	2010	2011 Q4
Total employed	20,257.6	18,888.0	18,456.5	17,807.5
Employed, industry	3,004.7	2,565.4	2,414.9	2,526.3
Percentage	14.8%	13.6%	13.1%	14.2%

Source: INE Economically Active Population Survey (EPA).

As industrial activity decreases, employment in the sector also decreases. A significant number of industrial jobs have been lost and the total number of employees has decreased⁹ in recent years (Table 23).

The industrial sector has many areas of activity, or subsectors, not all of which have evolved equally. This section describes some areas that have increased their number of employees in recent years. Most notably, from 2000 to 2007 employed persons in the subsectors dedicated to recycling metallic and non-metallic waste and scrap in Spain increased by 764% and 200%, respectively (UNIDO, 2012).

In 2008, industry in Spain was responsible for 31% of total greenhouse gas emissions, which included 104.5 million tonnes of carbon dioxide (CO₂). The industrial subsectors that most contributed to this were the manufacture of non-metallic mineral products, including cement (which was responsible for 13% of total emissions), petroleum refineries and fuel processing plants (5.6%) (INE data, 2012).

The basic industry¹⁰ subsectors in Spain that will be analysed in this section are:

- Iron and steel.
- Aluminium.
- Cement.
- Pulp and paper.
- Recycling.

These were chosen because they involve industrial raw materials and are energy-intensive areas with an impact on added value and level of employment. The evolution of this group of industries has implications for the entire economy.

UNIDO statistics make it possible to approximate the relative magnitude of these subsectors with regard to value added and total employment in the sector (Table 24).

In 2007, these subsectors accounted for approximately 12% of total industrial employment and contributed 15.5% of the added value; both of which had increased since 2000. During this period the number of employed persons in recycling activities, an area that creates green jobs, and its percentage of added value within the manufacturing industry increased almost five-fold. Even though this is a small portion of the total, it indicates strong growth.

Globally, the production of iron and steel, aluminium, cement and pulp and paper are responsible for a considerable portion of the energy and raw materials consumed, as well as greenhouse gases emitted, but only a relatively small portion of global employment. Since these energy-intensive products are basic elements of today's societies, the industrial subsectors that produce them pose a very significant environmental challenge per unit of value and employment. Greater alignment and balancing of environmental needs with the use of these services and products would involve increasing energetic and material efficiency while reducing pollution and improving scrap recycling.

However, the companies that generate most pollution also present the best opportunities for creating significant numbers of green jobs, since changes in production and/or consumption patterns in these industries and industrial processes would significantly improve the environment (ILO Brazil, 2009).

⁹ Though in 2011 Q4 a slight increase in employment can be observed with regard to the prior year, this does not yet indicate a change in the overall trend.

¹⁰ This refers to industries that begin the productive process by transforming raw materials into semi-elaborated products that are used by other industries for elaboration of final products.

Table 24. Basic industry in Spain: percent of total industrial employment and value added by subsector, 2000 and 2007, UNIDO data¹¹

	Employment				Value added			
	Number of employees		Percent of total for industry %		Billions of US\$		Percent of total for industry %	
Basic industry subsector	2000	2007	2000	2007	2000	2007	2000	2007
Iron and steel	37,328	38,919	1.54	1.62	2,626	6,135	2.84	3.29
Base, precious and non-ferrous metals (including aluminium production)	13,781	15,466	0.57	0.64	1,073	2,440	1.16	1.31
Non-metallic mineral products (including cement production)	150,873	168,053	6.21	6.99	6,411	14,739	6.93	7.90
Pulp and paper mfr.	54,413	53,140	2.24	2.21	2,791	4,920	3.02	2.64
Metal waste and scrape recycle	402	3,472	0.02	0.14	15	341	0.02	0.18
Non-metal waste and scrap recycle	1,124	3,377	0.05	0.14	42	262	0.05	0.14
Total, selected subsectors	257,921	282,427	10.6	11.7	12,958	28,837	14.0	15.5
Total, manufacturing industry	2,429,195	2,403,070	100.0	100.0	92,539	186,524	100.0	100.0

Source: Author's own based on UNIDO data, 2012

4.3.2. Green jobs in basic industry in Spain

In a green economy, two motors drive the creation of jobs in basic industry. The first is the direct creation of green jobs by reducing the environmental impact of industry. This is best achieved by increasing energetic and material efficiency, which reduces pollution from production, and by recycling.

Some examples of this are the energy savings offered by the production of recycled steel and aluminium. Secondary production of steel based on scrap recycling requires 40-75% less energy than primary production and thus constitutes a valuable measure for more environmentally sustainable production. Recycling aluminium requires only 5% of the energy used to produce aluminium from primary natural inputs such as bauxite.

In the transition towards a greener economy, a second motor for creating green jobs involves the expansion of sustainable sectors that could increase the demand for what basic industries produce. For example, manufacture of low-consumption vehicles could increase the production of steel; aluminium production could increase to satisfy the demand for wind turbines; and the construction of energy efficient buildings could increase the production of cement. Indirect jobs stemming from an increase in final demand in another sector of the economy are

not necessarily green jobs¹². Again, improving the environmental impact of basic industries through recycling and greater efficiency in production and energy use are keys to the sustainability of the Spanish economy.

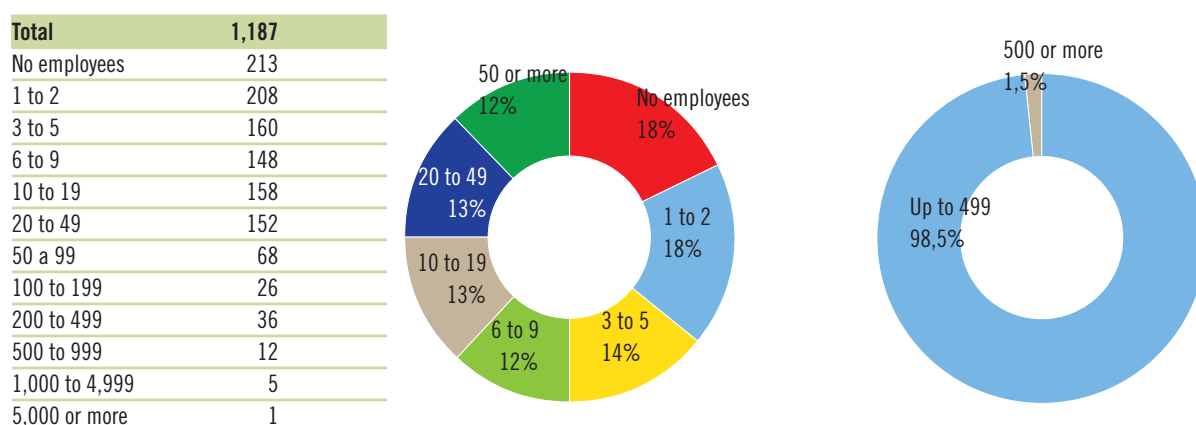
Examples of green jobs can be found in the 2011-2020 Renewable Energy Plan. For example, the raw materials most used in solar thermal installations are copper, aluminium, steel and fibreglass, representing 7-18% of the total investment cost.

Opportunities for creation of green jobs in the steel, aluminium, cement and pulp and paper subsectors are presented below. For a discussion of the recycling subsector, see Section 4.5 on waste management, processing and recycling.

¹¹ The data in Table 24 should be considered approximate and indicating an order of magnitude. Methodologically, comparison of this data with the data offered by the INE is not advisable, since the level of aggregation of each subsector does not allow for individualization. Other intervening variables might also affect the data, such as the exchange rates used to convert the values from the local currency to US dollars. Additionally, the 2007 end date in Table 24 does not reflect the effects of the crisis that began in 2008.

¹² According to the ILO-UNEP-ITUC-IOE, green jobs are "those decent jobs created as a result of a reduction in the environmental impact of companies, sectors and economies as a whole".

Graph 8. Companies by number of employees: metallurgy and manufacture of iron, steel and iron-alloy products, 2011



Source: Author's own based on INE – DIRCE data.

Iron and steel

The market volume of the Spanish iron and steel industry is the third largest in the European Union, after Germany and Italy. The Union of Iron and Steel Companies (UNESID) reported Spanish steel production to be approximately 15.6 million tonnes in 2011, 4.7% less than in 2010. Production in January of 2012 was 13% below that of January, 2011 (UNESID, 2012). Two causes behind the decrease in steel production in Spain are decreased activity in the construction sector and the relative strengthening of the Euro until September of 2011. According to UNESID, the latter negatively affected the balance between exports and imports (Hispanidad, 2012).

The steel industry employed approximately 27,000 workers in 2007 (Platea, 2007). According to a 2010 ILO and Sustainlabour document based on data from prior years, “there was no negative impact detected on the number of employees in the iron and steel subsector as a consequence of the environmental measures deriving from the National Allocation Plan of greenhouse gas emissions and related measures; while the effects of the crisis have not yet been felt, although the employers (UNESID) and the government coincide in an unfavourable forecast for 2009, when the effects of contraction of demand reach this subsector”.

The Central Company Directory (DIRCE) listed a total of 1,187 companies dedicated to metallurgy and the manufacture of iron, steel and iron-alloy products in 2011. Graph 8 below shows the distribution according to number of workers.

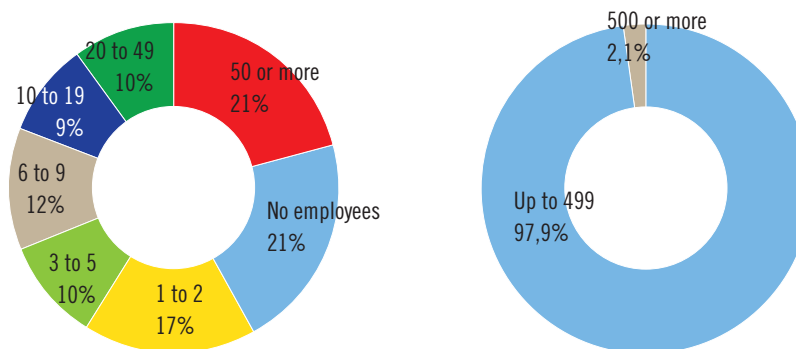
Large companies, those with 500 or more salaried workers, represent only 1.5% of the total; companies with 50-499 workers represent 10.5% and companies with less than 50 employees comprise 88% of the total number of companies in this area.

The steel manufacturing process consumes a great deal of energy, which results in significant emissions of greenhouse gases. Production of one tonne of primary steel generates some 1.7 tonnes of CO₂. Secondary steel is produced by direct melting of ferrous scrap in electric arc furnaces. Serviceable ferrous materials can include scrap metal, shredded vehicles, or metal and iron filings from direct reduction (CNR COP, 2012). Steel recycling saves 40-75% of the energy required for virgin steel production. Technological advances in the last two or three decades have improved energy efficiency and the use of sub-products, gases and materials; which has substantially reduced CO₂ emissions per tonne of steel produced (Renner, 2009).

Available data indicate that in 2008 secondary steel production represented 88% of total production in Spain. The energy intensity of the sector has also

Graph 9. Companies by number of employees: precious and non-ferrous metals, 2011

Total	281
No employees	58
1 to 2	47
3 to 5	28
6 to 9	35
10 to 19	26
20 to 49	29
50 to 99	24
100 to 199	18
200 to 499	10
500 to 999	5
1,000 to 4,999	1
5,000 or more	–



Source: Author's own using data from INE – DIRCE.

decreased considerably in the last decade. Estimates indicate an average energy consumption of 0.20 tep/t for steel in 2010 (National Allocation Plan of GHG Emission Rights, 2005-2007). Other countries with important recycled steel production as a percent of total production are Italy (77%), USA (64%), South Korea (52%), Russia/Ukraine (48%) and Germany (45%). Recycled steel production in Brazil, China and India is considerably lower (Renner, 2009).

Aluminium

The INE Industrial Survey of Companies listed 13,309 persons employed in the production of precious and non-ferrous metals (including aluminium production) in 2010, almost 2,300 persons less than in 2008.

The DIRCE provides information on corporations in the subsector by number of employees (Graph 9).

In the production of precious and other non-ferrous metals, large companies with 500 or more salaried workers represent only 2% of the total; companies with 50-499 workers account for 19% of the total and those with less than 50 employees represent 79% of total companies.

Primary aluminium production creates the greatest amount of greenhouse gas emissions per tonne of product. In recent years, however, this has improved considerably. In 2009, the European total for the production phase was 688 kg of CO₂ eq/t of

greenhouse gases emitted in alumina production, 1,941 kg emitted in primary production and 197 kg emitted in the production of recycled aluminium (EAA 2010).

Using recycled metals saves energy and preserves natural resources. As with steel, secondary production of aluminium offers the most significant means of greening this subsector. Secondary aluminium is obtained from recycled waste and is 100% recyclable, with no loss of its natural qualities. Recycling aluminium requires only 5% of the energy used to produce aluminium from primary natural inputs such as bauxite. From a technical and economic standpoint (feasibility and profitability), almost all aluminium products can be recycled repeatedly to create new products. In Spain, aluminium is used in the electrical, communications, transportation, construction, packaging and chemical industries. More sustainable and environmental forms of aluminium production will improve environmental impact throughout the economy.

In 2007, global production of aluminium was estimated at 45 million tonnes annually, of which some 14 million (one third of the total) involved secondary production (Das and Yin, 2007). For Spain, data from 2011 indicated that 60% of aluminium came from recycled materials. Half of the aluminium produced in Spain comes from vehicle scrap or recovery centres (*Nuestra Tierra*, 2011).

European rates of aluminium recycling are very high, ranging from 50% in packaging to 85% in

construction to 95% in transportation. Annual production of recycled aluminium is around 4 million tonnes. Estimates suggest that this industry generates over 10,000 direct and indirect jobs in Europe (ARPAL, 2009).

In 2002, some 243,000 tonnes of aluminium were recycled in Spain. In 2010, 35.3% of aluminium packaging was being recycled by means of traditional recovery, sorting plants, composting plants and other means of recovery (ARPAL, 2012).

Cement

In 2011, 21.98 million tonnes of cement were produced in Spain, 16% less than in 2010. During December, 2011, production was 1.29 million tonnes, marking an interannual decrease of 20.6%. Clinker production for 2011 was 18.21 million tonnes or 14.2% less than in 2010 and December, 2011 production was 675,508 tonnes, a 45.8% decrease from December of 2010 (Oficemen, 2012).

The collapse of the construction sector is the likely reason for decreased cement production, along with the relative appreciation of the Euro. In 2011, exports fell 1.1% with respect to 2010, but imports also decreased more than 39% in the same period (Oficemen, 2012).

Although productivity in the subsector had increased 40% before 2008, with a profit margin of 52%, this growth did not translate into job creation. According to the 2006 Industrial Companies Survey (EIE), growth occurred at a rate of approximately 12% between 2001 and 2004, then stabilised at around 10,000 workers. Cement subsector employment increased 0.6% and employment in the lime subsector increased 1.7% in the 2005-2008 period, followed by a sharp decrease in 2009 (ILO and Sustainlabour, 2010). Oficemen statistics for 2010 report a total of 5,694 workers in the cement subsector in Spain.

A 2009 report by the Ministry of Industry, Tourism and Commerce described the subsector as vulnerable to economic crisis. The report indicated a 30% drop from 2008 in cement production and predicted a downward trend in activity. It also mentioned that production satisfied national demand and that subsector access to foreign markets had scarcely been developed. Perspectives for the future are very uncertain.

In 2011, 233 companies were classified as manufacturers of cement, lime or plaster. Graph 10 shows the overall distribution by workers.

Companies with 500 or more salaried workers represent less than 2% of the total; companies with 50-499 employees comprise 10% of the total and companies with less than 50 workers account for 88% of total companies.

Greenhouse CO₂ emissions in the subsector can be reduced by improving energy efficiency and using different materials in the manufacture of clinker. By substituting up to 15% of the limestone used in making cement clinker with other materials, CO₂ emissions could be reduced by up to 240 tonnes per year. Substituting materials include fly ash, blast furnace slag and pozzolana (materials that contain reactive silica and/or alumina) are considered some of the best alternatives for limestone due to their availability, their capacity for creating quality cement and their contribution to reducing CO₂. Other alternatives to limestone clay include calcium sulphates, iron oxides, silica, carbon ash, sodium carbonates and sodium chloride (*Green Jobs Report*, 2008).

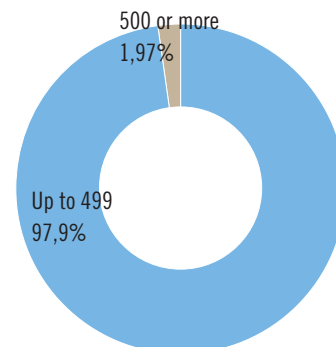
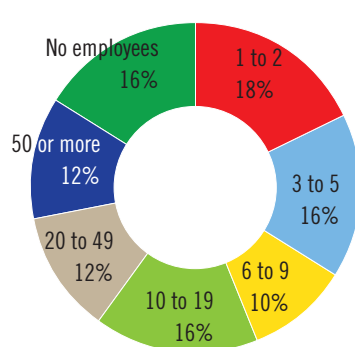
Important measures to optimise energy efficiency and develop processes and products that are less energy intensive have been implemented in the cement subsector in the last 25 years. According to the National Allocation Plan, the margin for greater energy efficiency in this subsector is limited in relation to the world's largest cement producers. Spanish producers as a whole are two points more efficient than the European average. Emissions decreased by 14.5% between 2005 and 2008, mainly due to the decrease in production.

However, there is still room for significant environmental progress in this subsector. Spanish cement production has a long way to go towards developing ways of reutilizing cement. A 2005 survey found that cement re-use in Spain and Italy was 10%, compared to 90% in Belgium and Denmark.

The cement subsector is not expected to be an important source of new job creation, as the most energy-efficient factories require fewer workers. A large, highly automated plant can often be effectively managed with a workforce of 200 persons or less. Excluding China, the average number of employees needed to produce a million tonnes of cement fell from 555 in 1980 to 272 in 2000. The 2008 forecast

Graph 10. Companies by number of employees: cement, lime and plaster manufacturing, 2011

Total	233
No employees	38
1 to 2	42
3 to 5	38
6 to 9	24
10 to 19	36
20 to 49	28
50 to 99	11
100 to 199	6
200 to 499	5
500 to 999	4
1,000 to 4,999	1
5,000 o más	–



Source: Author's own using data from INE – DIRCE.

was for a decrease in cement subsector employment if trends continued.

Work in a more efficient cement subsector will require a higher degree of professional skills and better training programmes for workers. Some new, short-term jobs may be created by construction projects, but this will not be sufficient to replace the number of jobs lost. A employment transition programme that ensures alternative employment for those affected will be necessary.

Pulp and paper

The pulp and paper subsector in Spain is flourishing and expanding at a rate above the EU average and also above the national GDP growth rate. It is now the fourth largest exporter of cellulose in the EU and the seventh largest in the world. Production increased 46% from 1995 to 2002 and before the current recession it was estimated that 2012 production would almost double that of 1990 (+91%). In spite of the current global economic climate and evidence of deceleration between 2007 and 2008, production increased consistently from 2005 to 2008.

According to national employment statistics, the paper industry employed 45,300 workers in 2010¹³, which was equivalent to 0.25% of the total workforce.

Of the 1,909 cellulose companies registered in the 2011 DIRCE (277 less than in 2008), 87% were listed as manufacturers of paper and cardboard products, while the remaining 13% manufactured paper paste, paper and cardboard. Analysis of these companies by number of salaried employees reveals a somewhat more balanced distribution than in other subsectors (such as waste management). Companies with more than 50 salaried workers represent 10% of the total (Graph 11).

Less than 1% of paper industry companies employ more than 500 workers; 9% of the companies employ 50-499 salaried workers and companies with less than 50 workers comprise 90% of the total.

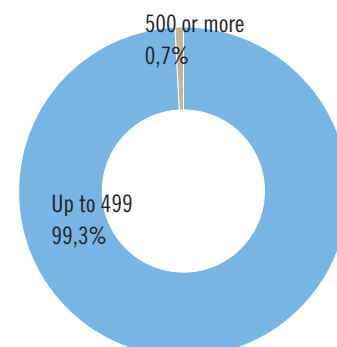
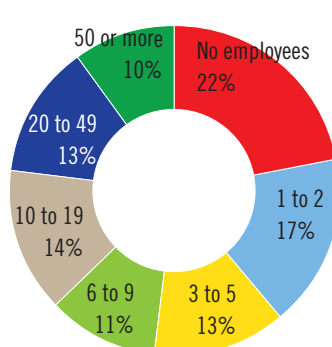
Recycling is the fastest-growing source of new green jobs in the pulp and paper industry. This activity is labour-intensive and creates more jobs than incineration or landfill sites.

Significant efforts have gone into making this industry more sustainable in recent decades, such as the substitution of oxygen for chloride in the whitening process. This industry has also advanced considerably in energy efficiency and recycling. However, even with these improvements, paper manufacturing is still one of the most resource-intensive industrial processes, involving large amounts of fibre, water, chemical products and energy. The pulp and paper industry is responsible for approximately 5.7% of total industrial energy consumption and is the fourth largest industrial user of energy after the chemical, iron/steel and cement subsectors.

¹³ CNAE Opening 17, 2009.

Graph 11. Companies by number of workers: paper industry, 2011

Total	1.909
No employees	419
1 to 2	329
3 to 5	257
6 to 9	220
10 to 19	259
20 to 49	243
50 to 99	86
100 to 199	56
200 to 499	27
500 to 999	11
1,000 to 4,999	2
5,000 or more	–



Source: Author based on national statistics (INE – DIRCE) data.

INE data on atmospheric emissions indicates that the printing, publishing, graphic arts and reproduction of recorded media industry contributed 3.86 million tonnes of CO₂ to the atmosphere in 2008, representing 1% of Spain's total that year.

Sustainability in the subsector is positive: in 2010 the Spanish paper industry recycled over 5 million tonnes of used paper, equivalent to 71.9% of all paper and cardboard consumed in Spain. This places Spain at the forefront of paper recycling in Europe, second only to Germany in volume of recycled paper and on par with France and Italy. The result is a significant reduction of landfill space and 4.1 million tonnes CO₂ emissions reduction in landfill, which account for about 1% of total emissions in Spain (Aspapel, 2011).

There are no data on green jobs in this subsector for Spain, but information from other countries can give an idea of the potential for green job creation in this subsector.

A 2011 report by Friends of the Earth indicates that a paper recycling programme for the United Kingdom would provide jobs in collection systems, sorting plants, paper recycling mills and the design, marketing, publicity and distribution of recycled paper products. Quantitative data from associations and entities in the United States indicates that for every 15,000 tonnes of newsprint recycled annually, 30 collection jobs, 40 processing jobs and 75 manufacturing jobs were created (Right Way Recycling, Paper Facts, etc.).

4.3.3. The future of green jobs in basic industries in Spain and the need for a just transition

There is potential for job creation in all the subsectors discussed in this section. Progress to date and future perspectives are classified as good to excellent. The recycling industry stands out as having excellent potential for green job creation and provides direct opportunities to reduce environmental impact. Thus, energy consumption in this subsector is significantly lower for comparable production levels, resulting in a proportional reduction of environmental impact.

The 2008 UNEP-ILO-IOE-ITUC Green Jobs study evaluated the progress and future potential for green job creation in these industries (Table 25).

Job creation potential is high due to the labour-intensive aspect of recycling and growth perspectives for the various subsectors. Recycling of cement and aluminium actually require fewer employees per unit than primary production. This affects the employment opportunity indicator of decent work, so that just transition measures may be required in these subsectors.

Training and skill development policies are crucial for assisting workers in transition periods, since some of jobs may be affected by migration of productive processes when phasing in a greener economy. A 2011 ILO report indicates that in spite of efforts to include vocational training measures in environmental policies and the introduction of various environmental programmes in the higher

Table 25. Environmental potential and job progress by industry (current and long-term)

Subsector	Potential for creation of green jobs	Progress in green jobs to date	Long-term potential for green jobs
Steel	Good	Acceptable	Acceptable
Aluminium	Good	Acceptable	Acceptable
Cement	Acceptable	Acceptable	Acceptable
Pulp and paper	Good	Acceptable	Good
Recycling	Excellent	Good	Good

Source: UNEP-ILO-IOE-ITUC, 2008.

Table 26. Average annual income in the manufacturing industry sector and in the entire economy (Euros)

	Both genders	Men	Women	Gender gap
Average of all sectors	22,511.47	25,001.05	19,502.02	-22.0%
Manufacturing Industry	23,907.49	25,341.93	19,727.98	-22.2%
Sector gap	+6.2%	+1.36%	+1.16%	

Source: Author's own based on national statistics data, 2011.

education system, Spain still does not have a national strategy explicitly focused on the qualifications necessary for a greener economy.

4.3.4. Quality of employment

Traditionally, the industrial sector has provided workers with relatively favourable employment conditions. Trade union affiliation tends to be higher than in other sectors, which guarantees that workers have a framework for negotiation, more structured employment conditions and some basic protection against contingencies that arise during their working lives.

Spain provides official data on work-related accident rates, hours worked, average salary and pay increases for industry. UNIDO statistics regarding level of employment, participation of salaries in the added value of the subsector and worker salaries in current US dollars are available for some subsectors discussed in this section. The data show that industry salaries tend to be slightly higher than the national average, while the gender gap mirrors the national average and is unfavourable to women. The average annual salary of female workers is 22% lower than that of male workers in this sector (Table 26).

The aluminium subsector reflects the European average for industry. Alumina and metal production data show a workforce remunerated at a level at least 6.4% above national averages, even during 2009, which was a poor year for manufacturing in Europe (European Aluminium Association, 2011, 2010).

Between 2000 and 2007, Spanish industry incurred 25.4% of all work-related accidents requiring four or more days' absence, second only to construction. Industry was also responsible for 16.7% of work-related fatalities, occupying third place after the construction and transportation/logistics subsectors, respectively (INE, 2012).

The steel, aluminium and alloys subsectors are particularly risky for workers due to the conditions under which materials are handled: extremely high or low temperatures, noise, vibrations, etc. Operations in the iron and steel industries can expose workers to a broad range of hazardous working conditions or activities that might cause accidents, injuries, death or illness. Iron and steel production requires or generates a variety of breathable agents, including but not limited to gases, vapours, dust, smoke and aerosols. These involve various toxicological risks such as irritation, chemical asphyxia, fibrogenic, allergenic, carcinogenic and systemic toxins (ILO, 2005).

Oficemen 2011 data for factory workforce in the cement subsector show interannual decreases of 53% in accidents with temporary disability, 21% in accidents without temporary disability and 3% in lost days of work due to accidents; while the number of factory workers decreased 4.1%.

4.3.5. Final comments

Basic industry is an important sector of the Spanish economy, providing inputs for other sectors of activity, such as transportation, energy and construction. Recycling adds sustainability to the iron and steel, aluminium, cement and paper industries. Re-use of these materials saves energy and a variety of other materials as well. For example, the energy required for secondary production of aluminium from scrap is 5% of that required for primary production.

In a greener economy, the demand for workers in basic industry may also indirectly increase as demand increases for the resources involved in renewable energy production, low-consumption vehicles (steel and aluminium) and the construction of energy-efficient buildings (cement).

The perspectives for job creation in the subsectors analysed are good to excellent, although fewer models and quantitative estimates are offered than in other subsectors. This is due to the labour-intensive nature of the activities and expectations of growth in these industrial subsectors.

Basic industries are characterised by relatively favourable labour conditions. Available data only offer statistics at the industry level and do not allow full individualization of the characteristics of each of the subsectors analysed. The wage level in basic industry is slightly above the average for the entire economy and is higher for male than for female workers, as is the case in all productive sectors. The most common risks and dangers involve workers in the metal and mineral subsectors, who are exposed to extreme temperatures, noise and vibration. A high percentage of the total number of work-related accidents occur in these subsectors, though accidental fatalities are lower than the number of accidents requiring four or more days' absence from work.

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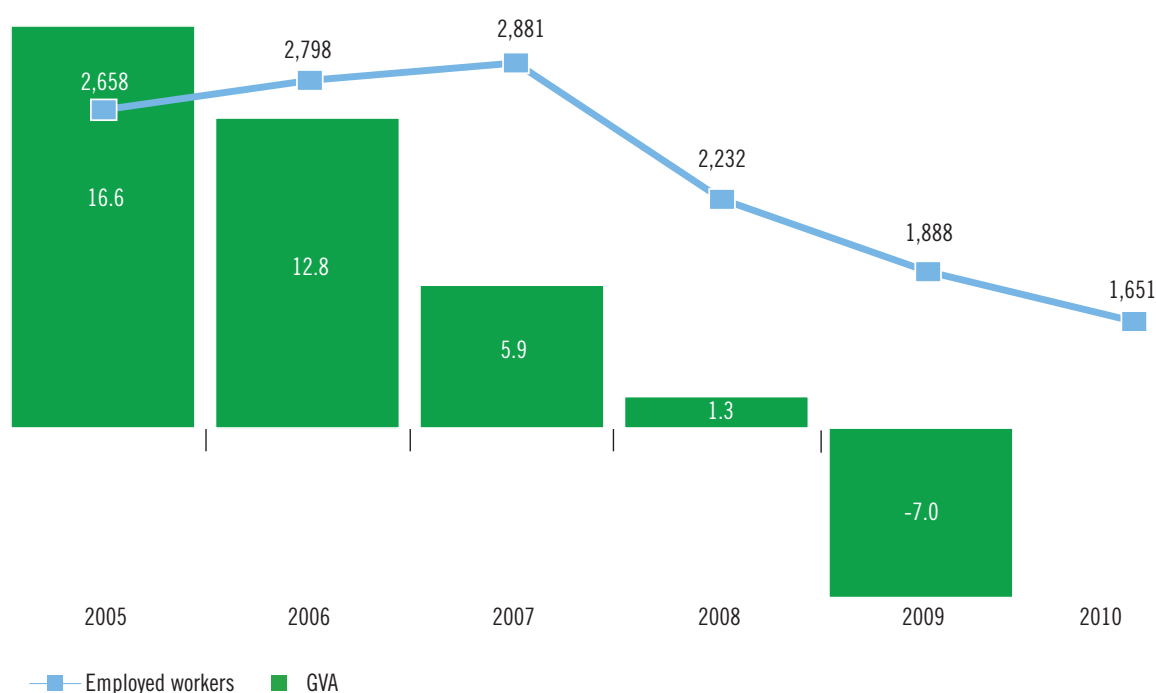
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4.4. Construction

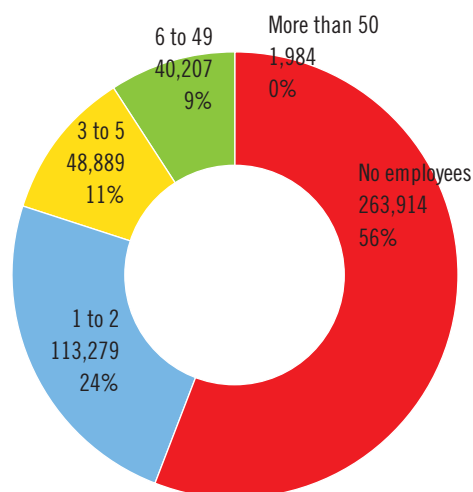
4.4.1. Environmental, economic and social impacts of sustainable construction and energy efficiency

The construction sector is fundamental to the Spanish economy and has played a decisive role in periods of both expansion and economic recession. In 2009 it contributed 105 billion Euros to Spain's

Graph 11. Employed workers and rate of change of GDP in construction 2005-2010



Graph 12. Proportion of construction companies (CNAE 2009:41 and 43) according to size by number of employees. 2011



Source: Prepared by the authors based on DIRCE (INE).

Gross Domestic Product (GDP) (10% of the total) and in 2010 employed 1,650,800 workers (9.0% of the total number of employed) (Graph 11).

Although there has been a drop since 2007, the weight of the Gross Value Added of the sector on Spain's GDP is double that in the EU-27 and the EU-15 (5.8% for both regions) (FB and OSE 2010). It could thus be interpreted that Spain is the Eurozone country where up till now development has depended to a great extent on the construction sector, which is why any plan for transition to a green economy must take this important fact into consideration.

Between 1996 and 2006, real estate activities and the construction sector went a long way to explaining the total increase in employment during this period, and investment in activities linked to residential real estate and non-housing related construction represented more than two thirds of the total growth in investment in that decade (ILO, 2011).

Symmetrically, a greater responsibility in the crisis currently afflicting Spain has been attributed to the sector. According to an ILO report (2011), the country has had to deal with two crises at the same time, the world crisis and its own crisis associated with a growth model excessively dependent on construction and housing. It has also been suggested that part of the crisis could have been produced by a residential offer which was excessive in terms of quantities and prices, making it difficult for

companies in the sector to complete works, close sales and repay loans.

The characteristics of the business fabric and the dynamic it has shown in recent years have had a fundamental impact on this phenomenon. As developed in the next section, building in Spain is described as a highly fragmented sector in which around 80% of companies have a maximum of 2 employees (more than 50% have none at all) (Graph 12).

Furthermore, during the real estate boom years (from 1997 until the collapse of the sector in around 2008), subcontracting of companies in the construction sector was widespread. This led to a worsening of employment conditions in the sector, as the long contracting chains (contractors and subcontractors) diluted responsibilities in matters of health and safety at work, often leading to job insecurity, high risks and high accident rates, a poor quality end product, processes with very little optimisation of resources, and even situations touching illegality (ISTAS and Fundación Conde del Valle de Salazar).

Around the fourth quarter of 2011 the construction sector recorded the figure of 453,000 unemployed workers (INE 2012), representing 8.6% of the total number of unemployed people and 18% of the unemployed who acknowledge being affiliated with some economic sector.

As far as environmental indicators are concerned, construction activity accounts for almost a fifth of the energy consumed in Spain and a quarter of its CO₂ emissions, according to the 2008-2012 Action Plan of the Institute for Energy Diversification and Saving (IDAE). The highest consumption comes from air-conditioning and sanitary hot water (SHW) production. Spain has an oversized stock of housing brought about by an excessive rate of construction with more than 25 million dwellings, a third of which are second homes or stand empty. In addition, this housing is relatively young and inefficient from an energy standpoint (ISTAS, 2011).

Spain has been working for a number of years on achieving these guidelines by developing legislation, both on a national level as well as regionally and locally, and creating bodies responsible for disseminating the established energy policies and ensuring that they are met. Under the current regulatory structure in Spain legislation on energy efficiency and renewable energies in construction is

possible, not just at a Central Administration level, but also through the Autonomous Regions and the Town Councils, who have been given powers in their territorial area in these matters (Ministry of Industry, Tourism and Commerce, 2010).

As far as the environmental adaptation of the housing stock is concerned, the standard with the greatest influence is the 2006 Technical Building Code (CTE), which applies to new buildings and to extensions, modifications, renovations or restoration of existing ones. This code adopts a so-called “objectives or services” approach, with the requirements to be met by the building or its parts and the characteristics of its materials, products or systems.

With the CTE, new and refurbished buildings must comply with a series of technical measures concerning the reduction of environmental impacts, safety and comfort of their occupants. On basic energy-saving requirements, the CTE requires the incorporation of thermal solar and photovoltaic energy.

According to IDAE estimates, the measures set out in the CTE could represent an energy saving of between 30 and 40% and a reduction in CO₂ emissions of between 40 and 55% in the sector (EOI, 2010).

With the entry into force of the planning instruments it was predicted that the architectural and building environment would undergo a considerable transformation. Changes in the way buildings are designed, built and maintained, together with modifications introduced in the production of components and energy use would affect the levels and composition of employment in the sector (UNEP, 2011).

Apart from the potential in terms of quality, it is important to emphasise that refurbishment could be an opportunity for a considerable improvement in employment in the sector in terms of quality. It would require a major training plan to adapt the design and technical skills of workers in many cases. It is also important to highlight that a series of new professional profiles would be needed, specific to the processes of refurbishment (ISTAS and Fundación Conde del Valle de Salazar, 2010).

One important aspect in construction is that, traditionally, it has hired workers with a wide range of qualifications. In addition to highly qualified workers, others with very few or no qualifications

—and usually with no assets to start up their own business— have been able to obtain an income.

4.4.2. Green jobs in construction

Sustainable construction can create jobs through a number of different channels. These could include construction using sustainability criteria, the restoration of existing works and the production of sustainable materials, products, electrical appliances and components. Jobs could also be created through the introduction and maintenance of energy efficiency measures and the connection with a variety of related activities that include the expansion of renewable energy resources, recycling and the handling of waste (UNEP, 2011).

For green jobs in the sector there are figures in Spain for the sub-sector of construction and consultancy activities linked to renewable energies (design and construction of plants, maintenance, etc.) which have already been entered into the energy sector accounts.

An estimate of green employment in the activity is given by the jobs linked to building renovation, and within these, to those related to energy efficiency improvements. According to the IDAE (2011), in the energy efficiency sector, construction activity contributed 1.705 billion Euros to the GVA and 32,744 jobs in 2009 (Table 26).

Some characteristic refurbishment actions designed to improve energy efficiency on buildings are: better insulation, the use of renewable energies and the installation of more efficient equipment. Noteworthy are actions to improve the supporting structure, the construction systems, the distribution, and internal conditions for well-being: which include hygrothermal¹⁴, lighting and acoustic conditions, air quality, improved maintenance or replacement of installations, and accessibility.

A number of studies have measured the impact on jobs for different aspects of energy efficiency. The FB and OSE report on green jobs reports the following.

¹⁴ In the context of hygiene conditions in working environments, the hygrothermal conditions are those determined by the temperature, humidity, air speed and thermal radiation. Hygrothermal comfort is the term used when there is no thermal discomfort.

Table 26. Construction's share in the GVA and employment in the PAEE* sectors

Construction sector	Billion Euros/jobs	% of the EE sector	% in Spain
Production (billions of euros)	4,605	21.46	0.22
GVA (billions of euros)	1,705	22.94	0.17
Employment (number of jobs)	32,744	30.98	0.16

*PAEE (Spain's National Energy Efficiency Action Plan 2011-2010: Agriculture, Construction, Domestic and office automation equipment, Industry, Public Services, Transformation of energy and Transport).

According to estimates by the German Council for Sustainable Development, for every million tonnes of oil equivalent (toe) saved through measures or investment in improving energy efficiency, instead of investments in energy production, more than 2,000 full-time jobs could be created.

An approximate calculation based on the value of the energy saved through a 1% increase in energy efficiency per year over a period of ten years shows that more than 2 million jobs could be obtained if these investments were made correctly in the building refurbishment sector.

The impact of the use of refurbishment measures on the existing stock of dwellings has also been examined, reporting positive net effects. According to a Ferrovial estimation, if between 250,000 and 400,000 dwellings a year were refurbished, between 180,000 and 290,000 direct jobs could be generated in the construction sector, reaching a market volume of between 9 and 14.4 billion Euros/year. This would prevent the emission of between 8 and 13 million tonnes of CO₂ in just three years.

Regarding the level of qualifications required for green jobs, some authors have indicated that the majority of the occupations will be similar to the ones already existing in the construction sector, incorporating key technical requirements and specific training (FB and OSE, 2010). In a study analysing the jobs created in a building refurbishment programme, Pollin and others (2008) suggest examples of the jobs which would be created if energy efficiency measures were introduced. There are jobs for electricians, heating or air-conditioning fitters, carpenters, construction equipment operators, roofers, insulation specialists, industrial truck drivers, construction administrators, building inspectors, etc.

At the same time, we see the appearance of some new professional profiles more specifically linked to

work on occupied buildings. Some are facilitators or management agents, whose task is engage residents and owners in the process. Others are specialists in operation and maintenance of buildings with energy efficiency criteria, installers of renewable energies, and energy auditors and technicians with specific knowledge of new construction materials.

In terms of the business structure within the construction sector, bearing in mind the number of employees in the companies that comprise it, the building sector is described as a highly fragmented sector in which around 80% of the companies have fewer than 2 employees (more than 50% have none). It should be pointed out, however, the importance of the number of workers represented by large companies. The high impact is noted here because of the rapid downsizing many of them have gone through since the start of the current economic crisis, with disastrous consequences for employment (Fundación Conde del Valle de Salazar in collaboration with CCOO, 2010).

In recent years hiring workers in construction has followed the trend for long contracting chains (contractors and subcontractors supported by a highly fragmented business sector), which have diluted responsibilities in health and safety at work. There are also grounds for belief in the existence of an informal economy. In Spain, subcontracting is a widespread practice in the construction sector. It is common to see a small number of large companies contracting smaller companies specialising in certain tasks to carry out part of the work they are executing (González Martín et al., 2010).

Job insecurity, high risk and accident levels and an end product of poor quality and poor optimisation of resources in processes were created as a result of the impact of subcontracting systems, the informal economy and the low levels of social responsibility

arising from the business culture (ISTAS and Fundación Conde del Valle de Salazar, 2010).

4.4.3. Green jobs in construction in the coming years

Given the large drop in employment experienced in the sector since 2007, and in the framework of national programmes designed to improve the energy performance within the sector, it is interesting to estimate the impact on employment levels and other macroeconomic variables that would come from the implementation of building refurbishment programmes in the next few years.

In quantitative terms, there are estimations carried out by the study published by ISTAS and the Fundación Conde del Valle de Salazar, in 2010. On the basis of a proposed possible refurbishment plan, the study projects the level of employment which could be generated in the period 2010-2040 if a certain percentage of the housing stock were subjected to this kind of work. The report predicts

volumes of employment in physical work-related activities (skilled workers, labourers, bricklayers, etc.), management jobs and technical jobs as part of the category of direct employment. In addition, multipliers are used to obtain an estimation of possible indirect jobs. According to the plan, a number of buildings for residential use built before 1979 (the date on which the Basic Building Standard for Thermal Constructions in Buildings (NBE-CT-79) came into force) should be refurbished. Refurbishment would take place in 565,000 dwellings a year (14.6 million over the years the project would last), reaching in 2040 an accumulated refurbishment percentage of 58% of the current housing stock.

The refurbishment programme comprises a set of seven technical measures to improve efficiency in building infrastructure and make the best use of energy. The amounts of investment required for the implementation of each of the proposed measures are provided. Next, based on estimations of the area to be refurbished (in square metres) and the labour factor required (measured in hours of work), the employment

Table 27. Measures programmed in the refurbishment plan 2010-2040

Measure	Investment (billions Of Euros)	Jobs created		
		Skilled worker	Labour/ Assistant	Total
Improvement of thermal insulation of façade (cladding)	13,138	88,548.79	88,548.79	177,097.58
Improvement of thermal insulation and waterproofing on the roof (cladding)	26,275	154,670.22	154,670.22	309,340.44
Improvement of thermal insulation and the solar protection factor of the glass (openings in the façade)	11,923	53,846.16	53,846.16	107,692.31
Improved waterproofing, conductivity and rupture of thermal bridge in window and door frames (façade)	70,289	123,397.44	123,397.44	246,794.88
Improvement of control elements, solar filtration and protection in openings in the façade	46,027	109,120.05	109,120.05	218,240.10
Replacement of fuel (and/or systems) from non-renewable sources, incorporating the use of renewable energies (thermal solar, biomass, geothermal, etc.) for climate control and HWS	40,988	94,626.67	94,626.67	189,253.34
Incorporation of the use of renewable energies (photovoltaic solar panels, wind generators) to obtain electricity	95,748	62,491.52	62,491.52	124,983.03
Investment in technical jobs	15,219			
Investment in management jobs	9,606			
TOTAL	329,214	624,209.33	624,209.33	1,373,401.68

Source: Prepared by the author based on ISTAS and Fundación Conde del Valle de Salazar 2011.

Table 28. Average annual income in the construction sector and in the economy as a whole (Euros)

	Both genders	Men	Women	Gender gap
Total economy	22,511.47	25,001.05	19,502.02	-22.0%
Construction sector	21,774.70	22,067.19	20,011.47	-9.3%
Sector gap	-3.3%	-11.7%	2.6%	

Source: INE, 2011.a.

creates is obtained¹⁵. The estimated occupations are those of Skilled Workers and Labourer/Assistant. Table 27 summarises this first series of results.

During the period of project implementation and for all the measures considered, 1.37 million jobs could be created and the amount of investment could be 329.2 billion Euros. This investment equates to a figure of 22,560 Euros per refurbished building. If the investment is broken down according to its main components, the largest item is the cost of materials (76.4%), followed by wage costs (19.7%) and other costs (3.9%).

From 2020 onwards, 13,143 new jobs could be created annually, which would suppose around 2.32 direct technical jobs for every 100 refurbished dwellings.

Using conservative figures, once the full implementation phase is reached, this could mean a potential of 105,000 fixed term jobs. More than 50% of these jobs are distributed primarily among skilled jobs and assistants, technical jobs and management jobs. The plan would generate numerous indirect jobs in the materials industry sector, in management, secretarial and accounting positions, as well as jobs associated with the energy sector.

The results discussed coincide with the expectations reflected in EOI study (2010). Of all the hypotheses proposed in the study, the one which arouses the greatest employment expectations is the

one related to refurbishment of the housing infrastructure.

In general, when it comes to defining the critical development factors, the experts consulted highlighted predominantly economic factors, with the exception of consultation in relation to urban planning, for which the political factors accounted for the majority of replies (42%).

4.4.4. Quality of the jobs created and just transition

The construction sector in Spain is sadly notable for its high accident rates. In 2009, construction accounted for 18.5% of the total number of accidents and 24.31% of all fatal accidents. In the biggest boom years of the activity, the number of fatal accidents in construction reached 31.6% of the total (2007), or 26.1% of total accidents in 2006 involving loss of time from work.

In the years before the crisis, the high demand for labour required was translated into irregularities in the contracting of construction workers. The trend for contracting chains (contractors and subcontractors supported by a highly fragmented business fabric) diluted responsibilities in matters of health and safety at work. There were also grounds for belief in the existence of submerged activities. The employment generated was of poor quality in the majority of cases, both in terms of stability and working conditions in general and in terms of qualification and technical requirements (Empleaverde Programme and others, 2011).

The details of salaries in the sector come from the Annual Survey on Salary Structure of 2009, and are detailed in Table 28.

In 2009 the average salary in the construction sector for both genders was 3.3% lower than the average figure for the economy as a whole.

¹⁵ For example, it is estimated that the total area of photovoltaic panels necessary for the refurbishment programme will be 200,150,764 m². The occupations involved in this activity are skilled glazier, assistant glazier, skilled electrician and assistant electrician. For all these occupations, a performance of 0.281h/m² is assigned. Considering average annual working hours in the construction sector of 1,800 hours, each worker could cover 6,405.7 m² per year. This gives a requirement for the project as a whole of 31,245. This same calculation is carried out for each of the components.

As regards the relationship between green jobs and indicators of decent work in the construction sector, following the same line of reasoning, the ILO warns that green jobs do not automatically constitute decent jobs. Many of these jobs are dirty, dangerous and difficult. Employment in construction tends to be insecure and the earnings from it low (Werna, 2012).

There is a risk of continuing with these bad practices in terms of labour relations, quality of the work, and a repetition of the lack of coordination, which were commonplace in the earlier period resulting from excessive subcontracting which placed more importance on reducing costs than on the end quality. Consequently, refurbishment should be associated with more control from the public administrations (Empleaverde Programme, 2011).

4.4.5. Final comments

Construction is a leading sector in the Spanish economy and its ups and downs have important consequences for the rest of the economy. In the decade prior to the crisis, the sector contributed greatly to the creation of jobs and income. Since 2008, the decline of the sector has generated an increasing number of unemployed.

There are a number of channels through which sustainable construction can create jobs. In both new construction and in refurbishment tasks, the introduction of energy efficiency measures and the use of sustainable materials have demonstrated the ability to create direct and indirect jobs.

Of all the channels mentioned, the refurbishment of buildings can be seen as one of the most important for the recovery of the sector which has been deeply affected by the current economic crisis. A large amount of work is expected to be generated for workers with different degrees of skill, but the greatest importance will be for unskilled workers, who are the ones who have had to suffer the most from the consequences of market stagnation and relocation difficulties.

This hypothesis is strongly supported by available employment projections and the expectations of the key informants in the sector consulted in this regard.

The sector is noted for its relatively bad working conditions. Job insecurity, high risks and accident

rates increased during the decade prior to the crisis, encouraged by a business culture in which the widespread use of contractor and subcontractor chains encouraged the dilution of companies' social responsibility. All of this has frequently resulted in a poor quality end product, processes with very little optimisation of resources and even situations of illegality.

Although green jobs in themselves cannot reverse this situation, building refurbishment may be an opportunity to improve the quality of employment in the sector considerably. Public policies in support of the sector and its workers are necessary to bring about this change. It requires a major training plan to adapt the design and technical skills of workers in many cases. It is also important to emphasise that a series of new professional profiles will be needed, specific to the processes of refurbishment (ISTAS and Fundación Conde del Valle de Salazar, 2010).

Other proposals include specific regulations defining the energy certification for existing buildings, a system for technical energy inspection of buildings, another for financing, as well as compulsory refurbishment objectives accompanied by ambitious aid programmes so that town councils can develop them through municipal refurbishment plans by neighbourhoods or districts. These proposals would be measures that would lead to their being achieved. The adoption of tax measures and measures to support renewable energies focussed on the thermal installations of buildings (biomass, solar thermal, geothermal, etc.) is also considered useful (ISTAS, 2011).

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4.5. Managing, treating and recycling waste

4.5.1. Environmental, economic and social impacts of managing, treating and recycling waste in Spain

Managing, treating and recycling waste is considered to be a core activity for the Spanish green economy. By Law 22/2011, dated 28th July, the sector includes collection, storage, transport, reuse, recycling, assessment and elimination of waste, including the monitoring of these activities and the surveillance of deposits or landfill after closure.

In 2009, the sector was contributing approximately 4.5 billion Euros annually to the Spanish Gross Value Added, representing 22.2% of the total generated in the green economy and approximately 0.43% of the country's GDP. Among core activities and related activities, there are 110,000 jobs in the sector, 33.9% of all employment generated by the green economy. Table 29 shows the sector's basic data according to EOI estimations for 2010. As shown in detail below, other sources have reported slightly diverging values. The Biodiversity Foundation (FB) and OSE (2010) estimate that there were approximately 140,000 jobs in the sector in 2010.

Regarding physical production volumes, 547 kg/person/year were generated in Spain in 2009 according to data from Eurostat. The final destination of this waste is shown in the following Graph 13.

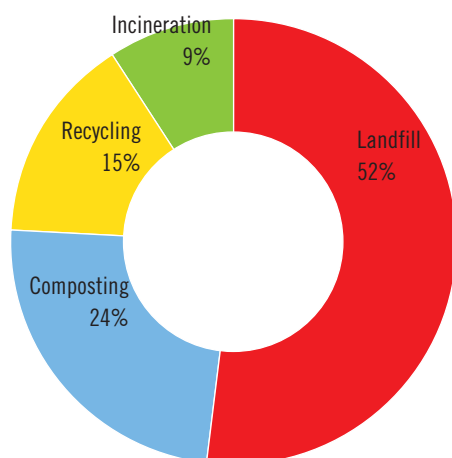
Waste per inhabitant per year turns out to be reasonably lower than the 636.2 kg/person/year produced on average in 2003, representing the peak in the 2002-2009 period. This tendency would however demonstrate the progressive proximity of waste production levels per capita in the EU-15 (FB and OSE, 2010).

The sector contributes 5.0% of the total greenhouse gas emissions (GHG). This value exceeds the EU-27 average of 3.2% for the same year and despite its low weighting in the Spanish total, its constant growth should be noted. It is the only sector that has increased the volume of emissions by above double levels between 1990 and 2009, rising from 7.6 to over 16 million tonnes of equivalent CO₂.

Among measures supporting the sector, the National Integrated Waste Plan 2007-2015 (PNIR) sets principles governing the field and a set of targets and physical goals for prevention, reuse, recycling, energy assessment and elimination for the different types of waste over the next few years. It backs sustainable infrastructures as an option for treating waste and prioritises waste management by composting the organic portion of municipal waste.

Reasons to promote developing the sector revolve around the need to preserve public health and minimise the risk of environmental damage, significant opportunities to create green jobs inherent to most initiatives in the sector and the possibility of saving energy and materials by recycling and making the most of a market that, at a global level, is worth approximately 315 billion Euros a year (Chaimin & Gaillochet, 2009).

Graph 13. Final destination of waste, 2009



Source: CCOO-ISTAS 2011 based on Eurostat.

4.5.2. Green jobs in the waste management sector

Opportunities to generate green jobs appear throughout the waste management chain although, relatively speaking, some segments within the sector generate a greater volume of employment per treated unit. Different types of data and studies, in all cases, reveal that increasing recycling targets tends to generate more employment. Evidence shows that, in general, recycling generates more employment per unit of waste than sending waste to be incinerated or to landfill.

According to a study by the Institute of Local Self Reliance, classifying and processing recyclable matter generates ten times more jobs than landfill or incineration per tonne of waste (UNEP, 2011). In the same respect, a 2005 European Commission report upholds that recycling is a source of employment: recycling 10,000 tonnes of waste requires up to 250 jobs, compared to 20 or 40 if the waste is incinerated or 10 if it goes to landfill.

A 2010 report by Friends of the Earth for Europe estimates that if the recycling target was 70% of some key materials, meaning an additional 115 million tonnes of glass, paper, plastic, ferrous and non ferrous metals, wood, fabric and biological waste, up to 322,000 direct jobs could be created in the EU-27 recycling field. These jobs would indirectly affect sectors related to the chain of value and have a knock-on effect throughout the rest of the economy, creating 160,900 indirect jobs and 80,400 induced jobs. Consequently, the total potential would rise to 563,000 new jobs.

Recovering and recycling electrical and electronic appliances generates service and technical jobs. This activity has implications for skills as they should be developed through national certification

Table 29. Basic figures from the waste management, treatment and recycling subsector. 2009

	Number of companies	Number of workers	Production (billion Euros)	GVA (billion Euros)	Apparent productivity (Euros)
Waste management, treatment and recycling	8,640	110,027	10.458	4.558	41,429
Characteristic activities (core)	8,605	108,335	9.992	4.441	40,995
Related or connected activities	35	1,692	0.467	0.117	69,222

Source: EOI, 2010.

programmes focused on repairing used appliances. In the same respect, Law 22/2011 on waste and contaminated soils establishes the promotion of reuse in section 1 of article 21 by stating that environmental authorities in their respective skills field, following prevention principles and promoting reuse and high quality recycling, will adopt the necessary measures to establish priority systems to promote the reuse of products and activities to prepare for reuse. Among other measures, they will promote setting up storage for waste likely to be reused and provide support for setting up reuse networks and centres. In addition, measures will be boosted to promote products ready for reuse through public contracting and quantitative targets in management plans.

Although waste collection, classification and reprocessing activities are labour intensive, it is hard to generalise the net effect on employment of making the sector greener or more sustainable. On a global level, it has been seen that the jobs created in recycling usually take home a low salary and replace jobs in other parts of the economy (Porter, 2002). Employment could drop as a consequence of centralisation operations for energy recovery and treatments such as composting and landfill (UNEP, 2011). In the process of becoming greener, job losses in industries related to extracting raw materials and associated services could be a cause for concern.

However, in Spain employment quality in composting plants, waste collection, treatment and classification is similar to other industrial activities. If selective municipal waste organic matter collection was considered by all cities, it would be possible to substantially increase employment associated with this activity, both collecting and treating this type of waste. There are undeniable environmental advantages to producing high quality compost and its use in agriculture to replace chemical fertilisers.

As far as employment is concerned, evidence generally supports the hypothesis of positive net effects. The latest study on generating employment in the CRI drinks containers sector analyses possible job losses in industries related to extracting primary materials and concludes that the number of jobs generated in the recycling sector compensates and exceeds losses in the extraction sector. The 2005 European Commission study warns that increasing

recycling would reduce employment in extraction and production of raw materials and to limited net job creation. Studies on other countries also come up with a positive net effect for recycling. For the State of North Carolina, it has been estimated that for every 100 jobs created in recycling, 13 jobs were lost in extracting raw materials and solid waste (CEQ, 1997).

This implies that while evidence indicates that the net effect on employment levels is generally positive, potential job losses demonstrate the need to monitor the sector, providing support measures for affected workers, including measures to combat job losses (in the case of extraction for example) such as training to develop new skills associated with current waste treatment methods.

Regarding the sector configuration and green employment figures in Spain, the country has 9,907 authorised companies in accordance with instructions set by the legislation in force regarding waste, for waste management and treatment. Their main activity involves managing non hazardous waste (87% of companies interviewed) corresponding to the composition of the generated waste. 61% of companies have between 2 and 50 workers and 18% are companies with just one worker (self-employed) (FB and OSE, 2010).

In order to estimate employment in the sector, the EOI 2010 counted all or part of the employment in the National Economic Activities Classifier (CNAE) records, 2009 edition, as shown below:

- Characteristic activities: 108,335 jobs.

CNAE category	Economic Activity
3811	Non hazardous waste collection
3812	Hazardous waste collection
3821	Treatment and elimination of non hazardous waste
3822	Treatment and elimination of hazardous waste
3831	Separation and classification of materials
3832	Assessment of pre-classified materials
3900	Decontamination activities and other waste management services
4677	Wholesale trade of scrap metal and waste products

- Related activities: 1,692 jobs.

CNAE category	Economic Activity
1711	Manufacturing paper pulp
2211	Manufacturing tyres and rubber inner tubes; rebuilding and retreading tyres
2410	Manufacturing basic products out of iron, steel and iron alloys
2821	Manufacturing furnaces and burners
3320	Installing machines and industrial equipment

The Fundación Biodiversidad (FB) and OSE (2010) published observations on sector employment for 1998 and 2009. The figures and growth over the period are presented in Table 30.

Table 30. Jobs in management, treatment and recycling waste, 1998 - 2009

1998	2009	Percentage variation
37,226	140,343	277%

Source: Fundación Biodiversidad and Observatorio de la Sostenibilidad en España (2010).

This significant growth in employment coincides with a trend to generate less waste per capita. Graph 14 shows the quantity of municipal waste collected for the period 1998-2009, measured per capita for the whole country.

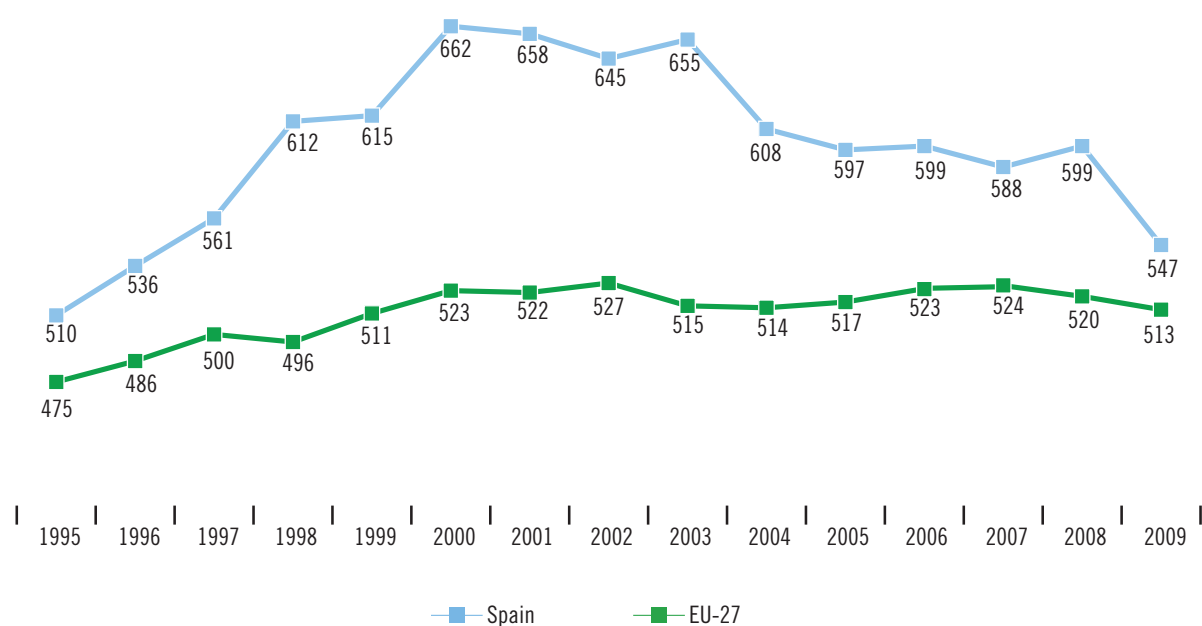
In Spain, the quantity of municipal waste has been falling over the last decade. After reaching a peak of 662 kg/person/year in 2000, the 2009 measurement was 547 kg/person/year, representing a drop of 17.3% on the maximum value recorded and a value approaching the EU-27 countries' average.

The reasons for this drop in urban waste generation include, first and foremost, falling average income among the population as a consequence of the worldwide economic crisis beginning in 2007. Just as waste volume and the complexity increase in times of economic expansion due to greater and more sophisticated consumption, a drop in income levels reduces consumption and so less waste is generated.

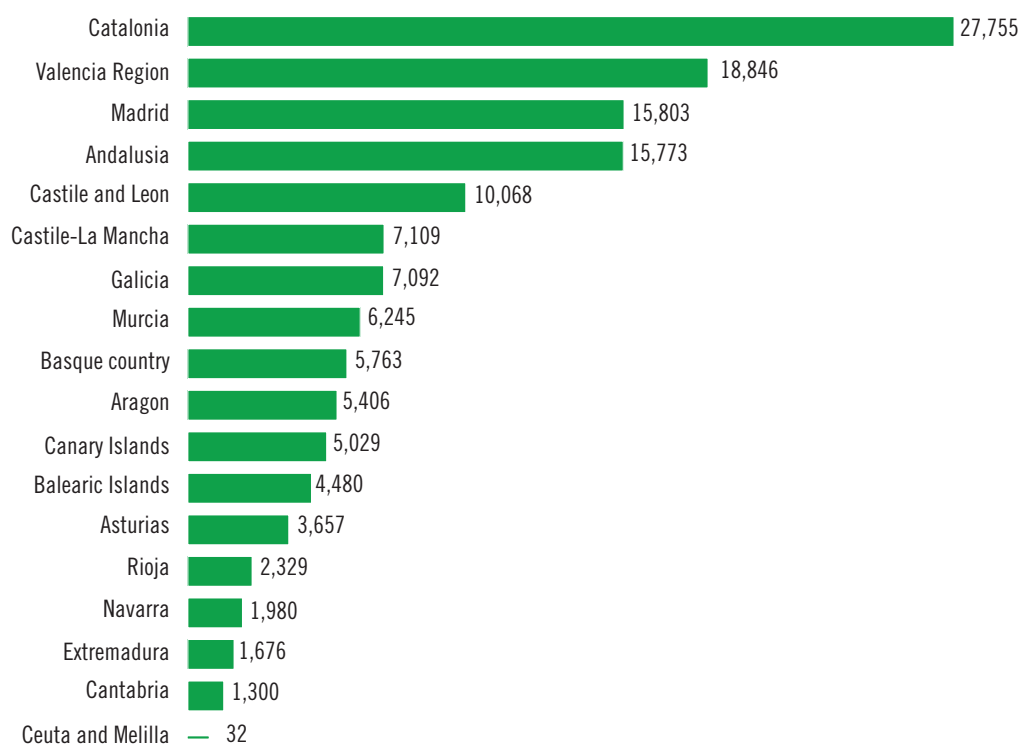
Higher growth in sector employment while the total amount of waste generated falls might also reflect the progress and greater sophistication in how waste is treated, eliminated and recycled.

Analysing employment by Autonomous Community shows that the four largest regions

Graph 14. Waste collected per inhabitant per year 1998-2009



Source: Eurostat 2011.

Graph 15. Employment in waste management by Autonomous Community

Source: EOI, 2010.

provide more than half the employment. Graph 15 presents the level of employment for each Community.

4.5.3. Green jobs in the waste management sector in the years to come

According to the study drawn up by the ISTAS in Spain, up to 14,000 jobs could be generated if a deposit, refund and return system (SDDR according to its initials in Spanish) was implanted in the country for drinks containers. As discussed below, the fact that the study refers exclusively to the drinks container market implies that there is significant room for improving job creation if municipal waste recycling targets were broadened.

The study analyses the impacts on employment of implanting a SDDR for single use drinks containers made out of glass, cans, plastic and cartons that contain water, soda, beer and mixers, carbonated drinks, juices and drinks containing alcohol. This system would therefore help to manage a portion of

the containers that is currently operated by enterprise resource planning (ERP): Ecoembalajes España, S.A. (ECOEMBES) and Ecovidrio.

In 2010, the volume of containers entering the market reached 2.73 million tonnes that corresponds to a figure of 2.88 million in 2014 calculated by extrapolation. For this year, it is estimated that the containers managed by ERP will be approximately 1.72 million tonnes of which 1.16 million could be managed by the SDDR. Table 31 shows the distribution of these totals according to the materials making up the packaging.

The model proposes a general treatment rate within the SDDR of 40% in 2014, formed by the treatment of glass packaging (46.5%), plastic (22.2%), cans (49.5%) and cartons (35.5%).

The starting hypothesis is that implanting and developing the SDDR will create new direct and indirect jobs. Some of the main new direct jobs will be in specific collection and counting activities and also in transport, along with jobs related to system management and administration. Vehicle and

Table 31. Volume of packaging introduced in the market in 2010 and estimation for 2014. Tonnes

	Total packaging 2010	Total packaging 2014	Total packaging ERP 2014	Total packaging SDDR 2014
Glass	1,537,549.74	1,648,852.63	881,971.27	766,881.36
Plastic	718,787.00	733,970.60	570,882.33	163,088.27
Cans	331,484.50	356,826.31	180,197.29	176,629.02
Cartons	144,450.09	141,292.44	91,091.24	50,201.20
Total	2,732,271.33	2,880,941.98	1,724,142.13	1,156,799.85

Source: ISTAS 2011.

Table 32. Summary of the employment generated in different SDDR activities in its implantation and operating phases

Activity sector	Product / Service	Implantation	Operation
Collection	Support for automatic machines		8,530 (*) + 362
	Manual		2,059 (*)
Transport	To counting plants		332
	To recycling plants		277
Treatment	In counting, classification and treatment plants		360
	Energy recovery: recovery and recycling		500 - 1,250
Administration, Design and training	System administration	Office/s	30 - 100
	Design	Computer programs to control the system; Counting, classification, treatment plants; Collection materials	30 - 100
		-	
	Training	144,4	
Manufacturing	Plant machinery	Counting and classification machines	(**)
	Collection machinery	Automatic machines	379 (***)
	Transport vehicles	Trucks	226
Maintenance	Plant machinery	Counting and classification	12 (****)
	Collection machinery	Automatic machines	240 - 328
	Vehicles		2.8 (*)
Construction	Plant construction	232	
	Adapting collection areas	116	
Total		1,127.4 - 1,197.4	12,692.8 - 13,600.8

(*) *Estimated figures based on working time: it does not imply necessarily employment creation.*

(**) *Part of the workforce in charge of the construction of counting and classification plants.*

(***) *Employment created outside the Spanish territory.*

(****) *Part of the total workforce of the counting plants.*

Source: ISTAS, 2011.

machinery maintenance activities should also be added to these jobs.

The main indirect jobs will emerge in the construction sector (counting and treatment lines; design and adaptation of collection spaces (automatic collection) and in industrial machine manufacturing

activities (automatic collection, counting and treatment for new plants), containers (storage), bags and labels (manual collection) along with manufacturing transport vehicles.

Regarding employment from manufacturing new vehicles, greater fleet needs might be anticipated.

Table 33. Jobs created in waste management in 2016

Activity	Jobs	University Graduates
Construction of new treatment facilities	10,700	1,500
Selection and classification plants: Removal, amplification and automation and treatment of organic matter	5,000	2,000
Energy efficiency of services and life cycle analysis of processes and products, Research, development and manufacturing of biodegradable materials, Research, development and implementation of new bioremediation technologies, prevention systems and clean technologies, awareness-raising and environmental education	2,500	2,000
Others (includes waste collection logistics, containerisation and new technologies, energy treatment of municipal waste, development and consolidation of the ERP, SDDR logistics and marketing, recovering of materials and selective recycling, management landfill, recovery of contaminated landscape and soil, consultancy and technical assistance	9,650	7,030
Total	27,850	

Source: ISTAS, 2011.

However, the lack of specific needs for the necessary vehicles (common container / trailer type) should also be mentioned.

Other municipal waste management activities will remain marginally affected by the SDDR, for example road sweeping activities. In principle, there are no activities on the fringes of the sector (indirect jobs) that introducing a SDDR might affect negatively (due to job losses). A summary of the jobs that could be generated are shown in Table 32.

In a system of this type, most employment is generated in the operating phase and within this, in the collection. In relation to other characteristics of this employment, it should be highlighted that it is vitally important for SDDR operation to remain constant over time, generating stable jobs. In addition, as these are activities requiring low qualifications, they represent an opportunity to find a job for vulnerable social groups, whose members very frequently lack of skills.

It should be clarified that the projections discussed refer exclusively to the packaging market and therefore there is significant room for improvement in generating employment if overall municipal waste recycling targets are increased. A study by the Jaume I University in Castellon evaluated the efficiency of municipal waste collection models in Spanish cities with over 50,000 inhabitants. The results reveal that in the best case scenario, 45% of paper would be recycled and 20% of metal and plastic containers, percentages that are far from the legal minimum targets. Spanish legislation aims to recycle 60% of

paper and cardboard collected in municipal bins, 60% of glass, 50% of metals and 22.5% of plastics. However, this study indicates that only the glass collection exceeds the required minimum (Fundación Eroski, 2011).

Other projections for the sector's future employment are presented by the ECOEMBES Chair. Based on recent studies, it has projected direct employment in managing municipal waste up to 2016, and it states that main green employment niche in Spain is currently waste management itself, also indicating forecasts for growth and professionalization.

The volume of direct employment to be created by 2016 according to these projections is 27,850 direct positions, distributed among the activities shown in Table 33.

In summary, distributing almost 28,000 jobs by level of qualification would give 31% workers with lower qualifications, 24% professions qualified at a Vocational Training and high school leaving certificate level and 45% university graduates in different specialities.

Quantitative projections by ISTAS and ECOEMBES coincide with qualitative information collected by surveys among key informants in the sector and other prognostic field studies.

A 2008 report from the Spanish National Employment Institute (INEM) analysed the sector's future job expectations by type of activity. Although the study was run some time ago and the legislation and the economic framework have changed since then, some of the trends observed in each sub-sector

are still valid. They are reported below and the statistical data has been modified accordingly.

In terms of **waste collection**, a moderate impact is expected on employment. Introducing new technologies in the collection trucks tends to eliminate the figure of the waste collection employee. Additionally, this is a mature sector that could absorb higher rates of waste generation without any difficulties. This falling trend could be partly countered by new needs for a selective collection workforce and due to the creation of new jobs associated with the managing of clean points (eco-parks) that might be significant.

Within waste treatment, **composting** presents good perspectives for creating jobs due to the increase in activity. Composting has increased to include up to 24% of total waste and the number of plants intended for this purpose has also gone up over the last few years. The PNIR 2007-2015 continues to back this type of infrastructure as a waste treatment option. The Plan envisages increasing the proportional quantity of selectively collected organic matter to at least 2 million tonnes to be sent to composting or biomethanation facilities. The creation of new companies and jobs is a direct consequence of these activities.

From an ecological perspective, **incineration** (energy recovery) is considered to be an end-of-pipe treatment method as it occurs at the bottom of the waste hierarchy. Energy recovery should only be carried out on waste that cannot be prevented, reused or recycled. The stated target is to increase this type of infrastructure from 2.1 million tonnes treated in 2006 to 2.7 million in 2012. It is hoped to have a moderate impact on creating employment.

Landfill is another end-of-pipe method, also one of the least favourable options environmentally. The target stated for 2012 in National Integrated Waste Plan (PNIR according to their initials in Spanish) is to eliminate 10-12% of municipal waste in landfill (this percentage is currently 52%,). The perspectives for generating employment in this activity are negative.

In order to **manage hazardous waste**, the absence of statistics and similarities between regions make it difficult to estimate future employment changes. It is estimated that it will be moderately positive and it will be fundamentally linked to starting up new treatment infrastructures because, as the PNIR 2007-2015 stated, current infrastructures are insufficient and in some cases obsolete.

The Industrial Organisation School (2010) report also raises this point. The interviewees considered that the field of treatment, inertization and hazardous waste management will be an important field within 4 to 7 years; in addition sustained, average generation is expected as the dangerous nature of this work makes highly trained and qualified human resources necessary.

On the other hand, Spain currently exports part of the hazardous waste to be treated and eliminated. There is therefore room to introduce new technologies to treat hazardous waste and a specific research opportunity to apply plasma technologies and other types of technologies aimed at eliminating or definitive inertization of hazardous waste (EOI, 2010).

According to data of the Ministry of the Environment and the Special Waste Administrators Association (2012) states that Spain produces 3 million tonnes of hazardous waste per year, registering import and export volumes in 2009 of 231,000 and 70,000 tonnes respectively. These figures have led to less optimistic opinions regarding generating employment in the sector, considering that Spain currently has over-capacity for treating this waste and so it would not be necessary to increase the number of plants.

4.5.4. The quality of the jobs generated in the sustainable sector and just transition

Based on field work in the sector, the FB and OSE (2010) document 98% of employment is fixed term and fulltime. Only 1.9% of workers on permanent contracts work part time and the percentage of employment corresponding to discontinuous employment is negligible (0.1%).

It also indicates that employment in the waste management and treatment sector is characterised by a low level of professional qualification. Fifty-six per cent of sector employees have a school leaving certificate, a basic qualification or hold no qualifications. The percentage of workers with Vocational Training studies (FP) is 27%, while only 17% have university studies.

Regarding workers' training needs and main qualification deficiencies, the study reveals that they are related to waste management, followed by other general

environmental matters (best available techniques, environmental risk analysis, environmental management systems, environmental legislation, environmental education, basic general training on environment, soil contamination, environmental impact study and corporate social responsibility). However, matters that are clearly preventive, such as eco-labelling, eco-design, green purchasing systems, and product lifecycle analysis, linked to an integrated management and the company's environmental commitment, raise limited interest.

Due to the activities undertaken by the sector, working conditions is a particularly sensitive issue: workers are exposed to waste or toxic substances, working on public highways, exposure to noise, vibrations, etc.

In a survey carried out in 2010 by the Andalusian Occupation Risk Prevention Institute among 572 workers in the sector from all hierarchic levels, working conditions were assessed. Some of the conclusions are discussed below. The sample demonstrates that most workers of the sector are men, 82.9% men compared to 17.7% women, that represents the same level of gender balance of the sector. As opposed to results reported by FB and OSE (2010), most workers had a qualification accrediting primary education. Only 5.6% of the sector had no education. 82.3% of the cases had a fixed term contract. The second category accounting 8.2% of total is the temporary contract due to production circumstances.

According to 25% of those interviewed, the main risk associated with the activity is traffic accidents. 22.4% consider the top risk to be cuts and jabs and 11.4% being run over, trapped or hit by vehicles. The prevalence of professional illnesses, diagnosed or in the process of being diagnosed in the period when the interviews were run, was 3.2% of the population working in the sector.

4.5.5. Final considerations

Management, treatment and recycling waste is a key area in the Spanish green economy due to its environmental, economic and social impacts. This sector generates the largest part of green jobs within the green economy: between 110,000 and 140,000 workers in 2009.

The sector presents significant green job expansion perspectives. Recycling creates more

employment per unit of waste treated compared to the end of pipe options such as landfill and incineration. Empirical evidence supports this statement. Different data and studies analysed show that increasing recycling targets result in an increase of employment. In particular the report presented by ISTAS that evaluates the job impact of a Deposit, Refund and Return System (SDDR) applied to drinks containers. The report shows that treating 40% of the current amount of drink containers consumed would result in the creation of 14,000 by 2014. It should be noted that many of these jobs would be created in a sector facing job losses due to the use of technologies such as waste collection trucks. Laid-off workers, very frequently unskilled, face difficulties to reinsert in other sectors of the economy.

Composting is also part of organic matter recycling activities, therefore an activity that generates employment. In Spain, the quality of employment in composting plants is similar to other industrial activities, including collection, treatment and classification of waste. If the selective municipal organic waste become a common practice, it would be possible to substantially increase green jobs associated with this activity, both collecting and treating this portion of waste. There are undeniable environmental advantages in producing high quality compost and its use in agriculture to replace chemical fertilisers.

Regarding the employment substitution effects due to the expansion of waste treatment technologies, it has generally been reported that the employment created exceeds job losses resulting therefore in a net effect. Recent studies that look at possible job losses in industries related to extracting primary materials conclude that the quantity of employment generated in the recycling sector exceeds the losses in other affected sectors such as the extraction sector.

The employment substituting dynamics that the sector will experience show the need to support the sector, particularly workers whose jobs might be at risk. In particular, training and skills provision to develop new tasks related to waste management and particularly providing skills training in terms of best available techniques, analysis of environmental risks, environmental management systems, environmental legislation, environmental education, basic general training on the environment, soil contamination, study of environmental impact and corporate social responsibility.

Finally, attention should be paid to the sector's working conditions, particularly relevant health, safety policies in relation to waste contact, toxic and dangerous materials, working on public roadways and exposure to noise and vibrations.

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In recent decades Spain has become a country that leads the promotion of green economy, in accordance with European targets and regulations. Despite the progress made in the economy and green jobs so far, the country is facing today tough challenges that require different degrees of action.

Due to the country's production structure Spain's energy dependence is very high resulting in a production system that is very vulnerable to external shocks and that contributes to an imbalance in foreign accounts. In relation to climate change, Spain is currently ranked among the countries more distant from meeting their Kyoto Protocol commitments, that means increasing GHG emissions up to 15% above 1990 levels. The GHG emission trend went down both in 2006, as a result of the measures adopted, and from 2008 on, as a result of the world economic crisis that impacted Spain.

In order to correct these unbalances and bring sustainability to the Spanish production model, a variety of policies and measures have put in place in the country in the last years. These measures affect the level and composition of employment and have generated both new green and presented new challenges to meet the needs for professional training and the replacement or disappearance of jobs in declining activities, due to their high level of energy intensity or their high volume of emissions.

The sound variety of green jobs-related regulations and the greater demand for environmental goods and services aiming at

improving the quality of life and sustainability are acting as driving forces to generate green jobs. It should be noted that the main driving force to create environment-related activities and green jobs is the broad range of legislation –environmental, economic, labour and sectoral–, including regulatory, planning, and management mechanisms added to the progressive improvement of knowledge and greater society's ecological awareness. The implementation of these strategies, laws, plans and programmes involved the definition, development and often financing programmes to support new green jobs.

The main environmental problems are a result of the impact of economic sectors on the consumption structure and lifestyles. The manufacturing industry's impact on environment is still very high, mainly due to its high consumption of natural resources and the pollution produced. The increasing impact on environment of the growing transport sector, together with growing intensive agriculture, mass tourism and uncontrolled urban developments should be added to the environmental impact from consumers, including homes. To respond to these challenges, different actions have been implemented to protect, improve and manage the environment, and that result in micro- and macro-economic dynamics that generate new green jobs.

Given the current economic circumstances and the in energy and environmental challenges, green jobs seem very likely to a possible approach to create sustainable and decent work. Green jobs initiatives

have a twofold aim: on the one hand, to combat the environmental challenges by protecting natural resources for future generations, and on the other hand, to offer decent work in a context where millions of people are excluded from economic and social development.

The transition towards a green economy has resulted in the creation of green jobs and sustainable sectors. These are the activities that incorporate energy efficiency or energy saving elements into their production processes or end products, such as sustainable transport, construction, low-emission vehicles production, secondary production of steel or aluminium, cement and recycled paper, to name a few.

To the extent that green economy sectors increase their participation in the economy, their demand and production will increase leading to additional new jobs created not only in these sectors but also in those sectors that are part of their value chains. These are known as indirect jobs and will represent new jobs and new incomes. These indirect jobs, however, can not be considered necessarily as green jobs.

Growing environmental responsibility of companies is likely to lead to an increase in the demand for waste management services, which alone could have a very important impact on green jobs creation.

As the sectoral analysis shows Spain already counts with a significant number of green jobs, green-related infrastructures and a sound business sector that will be translated into a large number of new green jobs created if measures, strategies and regulation already agreed are implemented and extended.

However, the challenges are still very important. At the writing of this report, according to the Survey on Economically Active Population, unemployment in Spain has reached 5,639,500 people or 24.44% of the workforce. The current Spanish economy's recession, caused mainly by the collapse of the construction sector and the economic slowdown result of the austerity measures that affect the public sector, require a review of figures of employment in all sectors, including green sectors.

Annex 1

Described below are the measures which have an impact on employment, either because they specify aspects of employment such as professional training, or because they set objectives and physical production targets which involve adaptation of the workforce that has to fulfil them. They are all part of the current package of measures that form the framework for sustainable development, and take into consideration all the sectors analysed in this report.

Spanish Sustainable Development Strategy (2007)

This Spanish Sustainable Development Strategy (2007) is part of the EU Sustainable Development Strategy (SDS), which was renewed at the 2006 European Council in Brussels with a general principle to “identify and develop actions to enable the EU to achieve continuous improvement of quality of life both for current and for future generations, through the creation of sustainable communities able to manage and use resources efficiently and to tap the ecological and social innovation potential of the economy, ensuring prosperity, environmental protection and social cohesion”.

The employment targets were aimed at reducing temporary employment, increasing the employment offer for older age groups and improving public employment and training services.

Plan E (November 2008)

Programmed for the period 2008-2010, Plan E focused on four areas of action: support measures for families and companies, pro-employment measures, measures to support the financial system and modernisation of the economy.

As regards employment, with an objective to create 300,000 jobs, a fund of 11 billion Euros was created. Part of this fund was primarily destined for the New Public Investment Fund in the local sphere (amounting to 8 billion Euros), and the rest to finance support measures for strategic sectors.

Sustainable Economy Act (LES) (2011)

The Sustainable Economy Act, of 4 March 2011, introduced a series of structural reforms to create a pattern of growth that would reconcile economic, social and environmental development in a productive and competitive economy. In addition, the Act also favours quality employment, equal opportunities and social cohesion as well as ensure respect for the environment and the rational use of natural resources in such a way as is to meet the needs of present generations without compromising the possibilities of future generations to meet their own needs.

The Act focuses on five main areas: competitiveness, environmental sustainability,

housing standardisation, innovation and professional training and economic funds for new sectors.

In the professional training system (FP), the Act introduces important reforms. The aim behind these reforms is to make it easier to adapt the training offer to the demands of the production system, broaden the offer of professional training, make progress in integrating professional training in the education system as a whole, and strengthen the cooperation of the education administrations (Cañizares, 2011).

Renewable Energies Plan in Spain (PER) 2005-2010, Renewable Energies Plan (PER) 2011-2020 and National Renewable Energies Plan (PANER) 2011-2020 (30 June 2010)

The Sustainable Economy Act states that the energy policy must be designed to ensure security of supply, economic efficiency and environmental sustainability. The Plan sets national energy-saving targets and promotes participation of renewable energies. In addition, it establishes the procedural framework for drawing up integrated planning of the energy model, it sets out the bases for the creation of Plans for saving and energy efficiency and it establishes the conditions required for the existence of a competitive energy market.

The PER was drawn up using fifteen general and sectoral studies, which analyse the technical, economic, social and environmental aspects in depth. One of these is the Study on employment associated with the boost in renewable energies in Spain 2010, the goal of which is to estimate the number of direct and indirect jobs in Spain in 2015 and 2020 associated with renewable energy sources. This also takes into account the Government's plans to provide an impetus for the participation of renewable energies in the future national energy mix and any possible economic scenarios.

This study shows that the future scenarios are for net creation of employment, either for the case that renewable energy participation targets set by the government are met or, to the contrary, the proposed targets are not reached (for details of this study, see Chapter 4).

Royal Decree Law 1/2012

RDL 1/2012 ordains the suspension the pre-allocation procedures and the financial incentives for new electricity production plants based on co-generation, renewable energy sources and waste. One reason behind the measure stems from the need to control the sector's tariff deficit. Another reason is the fact that growth brought about by technologies included in the special regime allowed the installed power targets envisaged in the Renewable Energies Plan 2005-2010 for wind technology and particularly for solar thermoelectric and photovoltaic solar systems (BOE, 2012) to be easily exceeded in 2010.

According to sector estimations, this measure could have an affect on 4500 MW of wind power, another 250 MW of photovoltaic and above all, on the industry that revolves around this activity. However, 1,600 MW of wind power that could be developed will be unaffected since it appears in the Ministry of Industry pre-registry. This also goes for 1,200 MW of solar thermal power. As far as employment is concerned, the Royal Decree does not set any measures for the 10,000 jobs which this sudden halt in the installation of new renewable power with premium will suppose, as reported by the Photovoltaic Industry Association (ASIF).

Integrated National Automotive Plan (2009), Automotive Sector Competitiveness Plan. Sustainable mobility. Movele

The Integrated Automotive Plan, approved by the Council of Ministers on 13 February 2009, is an integrated set of measures designed to preserve the automotive sector's national production fabric in the ecologically innovative vehicles segment (hybrids and electric) to make it more competitive.

One of the goals of the Plan is to reach a million hybrid-electric vehicles in the Spanish automobile fleet by 2014, and foment the development of the industry in Spain making the offer these vehicles possible.

The employment component, the application of which falls under the responsibility the Ministry of Employment and Immigration, includes measures to manage the employment transition in the sector.

State Housing and Refurbishment Plan (2009-2012)

The State Housing and Refurbishment Plan came into being with a dual strategy in mind. From a structural viewpoint, it establishes stable long-term bases of reference for housing policy instruments that are designed to improve access to, and use of housing by members of the population with difficulties. From the viewpoint of the current economic situation, it addresses the specific reality affecting the housing cycle and demands specific decisive measures to avoid further deterioration of the situation. Furthermore, the Plan provides the opportunity to achieve efficient allocation of resources, with excess housing production destined to cover the needs of the population.

The construction case is paradigmatic due to the weight attributed to the sector in the current crisis and the increase in unemployment. According to the LES, “the crisis in Spain has had the singular effect of bringing about a particularly abrupt adjustment in the construction sector which began in 2007. As a result, and as this is a very labour-intensive sector, there has been a sharp increase in unemployment in a very short space of time”.

Article 107 of this same Act states that public authorities must formulate and develop the policies that fall within their remit to create a sustainable urban environment that favours required infrastructures, provisions and services and the implantation of activities with financial content that generate stable environmentally sustainable employment, particularly those which facilitate the development of scientific research and new technologies.

Note that the ratios for employment/capital invested are much higher in refurbishment than in new construction and particularly with regard to public works. In addition, the installation of renewable energies and the use of new materials and equipment will encourage the take-off of future technologies aimed at sustainable development. All of this requires that particular attention be paid to professional training and adaptation of the workers within the sector. They need to be provided, to different degrees and on different professional levels, with the necessary training. This training should include such aspects as insulation systems,

materials, installation and maintenance of thermal solar and photovoltaic energy, biomass or construction waste management and demolition, as well as possible reuse, which are very important in refurbishment works. These training actions could be carried out with sector workers who are currently unemployed due to the drop in new building activity through specific courses given by specialist organisations in the sector and the Autonomous Regions.

Integrated National Waste Plan (PNIR) 2008 - 2015

In December, the Spanish Council of Ministers approved the Integrated National Waste Plan (2008-2015). The aim of this Plan is to provide guidelines for the development of specific policies to improve waste management, thus reducing the generation of it and encouraging its correct handling in coordination with the autonomous regions and local bodies. The Plan includes measures to promote prevention, reuse and the implementation of selective collection to increase the recycling rate and reduce the amount of waste dumped in waste disposal sites (ISR 2012).

The target set for the 2009-2012 period is to assess 50% of the urban waste in this type of infrastructure foreseeing an investment of 324 million Euros. This investment figure is complemented with contributions made by the Autonomous Regions provided for in their respective regional waste plans.

In 2009 the Ministry of Agriculture, Food and Environment (MARM) provided for an annual budgetary contribution of its own of 23 million Euros to promote actions of general interest and innovative nature considered to be a priority to promote changes in waste management. In a similar vein, the National Plan for Scientific Research, Development and Technological Innovation (2008-2011), in its R&D+i programme, includes as one of its priority lines project financing designed to improve waste management (ISR, 2009).

According to the Spanish Government, this Plan will mean more efficient management, growth in the specialized waste management business sector and the creation of jobs as a result.

Elements to stimulate green employment Empleaverde Programme

In 2007 the Fundación Biodiversidad (FB) launched the Empleaverde Programme, with a pioneering vision of green employment as a new form of development to ensure economic development and respect for the environment. The Empleaverde Programme is an FB initiative to improve employment and the environment. This programme includes projects aimed to implement environment and sustainability related processes for change. With an initial provision of 44.1 million Euros for the 2007-2013 period, it has ambitious goals such as supporting more than 50,000 people and promoting the creation of some 1,000 companies in the environmental sector. And in line with the LES, the Programme it fosters actions to establish bases for a new model focused on innovation, knowledge and energy sustainability.

Up until 2010 the Programme had supported 80 projects in which a training-action model was applied designed to stimulate new economic activities and seek qualitative and quantifiable achievements to benefit workers, companies and, of course, the environment. These projects provide training for

more than 28,500 workers, and also help to convert some 850 companies over to the environmental sector. More than 550,000 workers are participating in one of the 2,000 or so actions implemented by the Empleaverde Programme and the projects themselves create 260 direct jobs.

Platform for Green Employment and Sustainable Economy

The Observatorio de la Sostenibilidad en España (OSE) is working on a Platform for Green Employment and Sustainable Economy, along the lines of the communication platforms it is developing.

The OSE's communication platforms with a participative and creative approach are a meeting point for interested parties and the economic and social players, civil society and administrations. The idea is to intentionally disseminate information that would lead to innovation.

The aim of the OSE's Platform for Green Employment and Sustainable Economy is to study, disseminate and promote activities which encourage the creation of green jobs as part of a sustainable economy.



GREEN JOBS FOR SUSTAINABLE DEVELOPMENT

A case study of Spain

The green economy offers enormous opportunities for job creation, many of which are already underway in the Spanish economy. These opportunities range from the sectors traditionally associated with an environmental content, such as renewable energies or recycling, and to other activities that represent emergent sectors in green jobs, such as sustainable mobility and activities in “traditional sectors” with potential for conversion into sustainable activities, such as production of cement, steel or paper.

This study aims to compile and analyze the data on green job creation generated by different institutions in recent years. This includes both current employment data and also studies of trends for some sectors. This study has been undertaken in an especially delicate moment for the Spanish economy, and this fact is reflected in the paradoxical nature of some of its conclusions. While the green sectors show good results in recent years, the impact of the current economic crisis and the modification of policies can considerably reduce the options of this growth tendency.

In Spain, the severity of the recession and the current austerity measures make it difficult to judge the future effect of general contracting in the sectors of the green economy. Nevertheless, some recent studies in Europe have demonstrated that these sectors have weathered the recession better than others by retaining more employment, and hence they would be particularly well situated for a future scenario of investment intended for the recovery of European economies.



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